Installation & Maintenance Data

IM 178-6

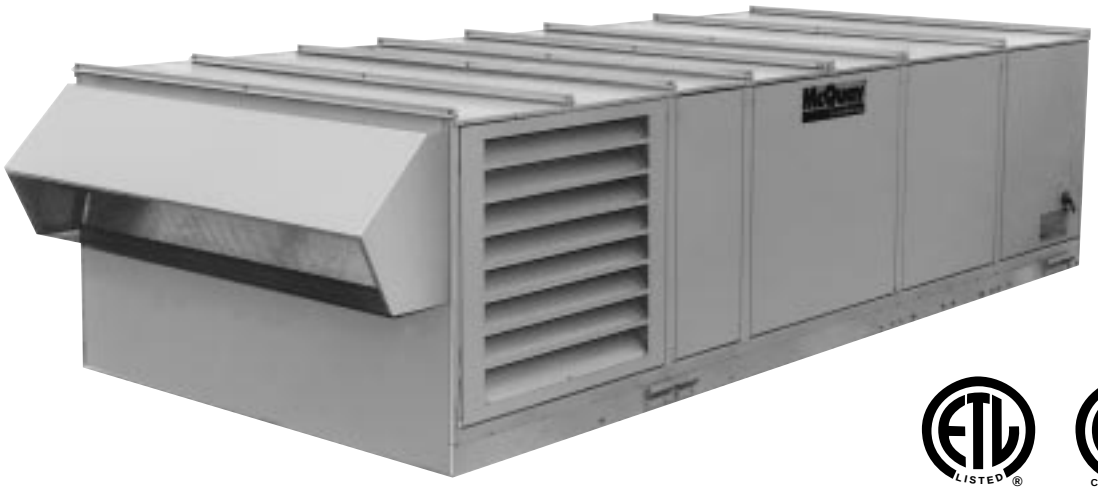
Group: **Applied Systems**

Part Number: **347673Y-01**

Date: **January 1997**

RoofPak® Applied Rooftop Systems Air Handler

RDS 800C & 802C



ISO 9002 CERTIFIED

McQuay® Air Conditioning

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Installation and maintenance are to be performed only by qualified personnel who are familiar with local codes and regulations, and experienced with this type of equipment. *Caution:* Sharp edges and coil surfaces are a potential injury hazard. Avoid contact with them.

Introduction

This manual provides general information about the "C" vintage McQuay RoofPak applied rooftop unit, Model RDS. In addition to an overall description of the unit, it includes mechanical and electrical installation procedures, commissioning procedures, sequence of operation information, and maintenance instructions. For further information on the optional forced draft gas-fired furnace, refer to Bulletin No. IM 684 or 685.

The MicroTech applied rooftop unit controller is available on "C" vintage applied rooftop units. For a detailed description of the MicroTech components, input/output configurations, field wiring options and requirements, and service procedures, refer to Bulletin No. 483, "MicroTech Applied Rooftop Unit Controller." For a description of operation and information on using and programming the MicroTech unit controller, refer to the appropriate operation manual (see Table 1).

Table 1. Applied rooftop unit operation manual literature

ROOFTOP UNIT CONTROL CONFIGURATION	OPERATION MANUAL BULLETIN NO.
Variable Air Volume (VAV)	OM 108
Constant Air Volume, Zone Temperature Control (CAV-ZTC)	OM 109
Constant Air Volume, Discharge Temperature Control (CAV-DTC)	OM 110

Nomenclature

RDS - 800 C Y E

RoofPak
Draw-through/Blow-through Coil Section

Cabinet Size
800 = 4,000 to 16,000 cfm
802 = 8,000 to 20,000 cfm

Heat Medium
A = Natural Gas
E = Electric
F = Fuel Oil
S = Steam
W = Hot Water
Y = None

Cooling Coil Size
L = Large Unit Coil
Y = Contractor Coil or None

Design Vintage

Receiving Inspection

When the equipment is received, all items should be carefully checked against the bill of lading to be sure all crates and cartons have been received. **If the unit has become dirty during shipment (winter road chemicals are of particular concern), it should be cleaned off when received.** All units should be carefully inspected for damage when received. If any damage is noticed, the carrier should make the proper notation on the delivery receipt acknowledging the damage. The carrier should also fill out a Carrier Inspection Report. The McQuay International Traffic Department should then be contacted at (612) 553-5330.

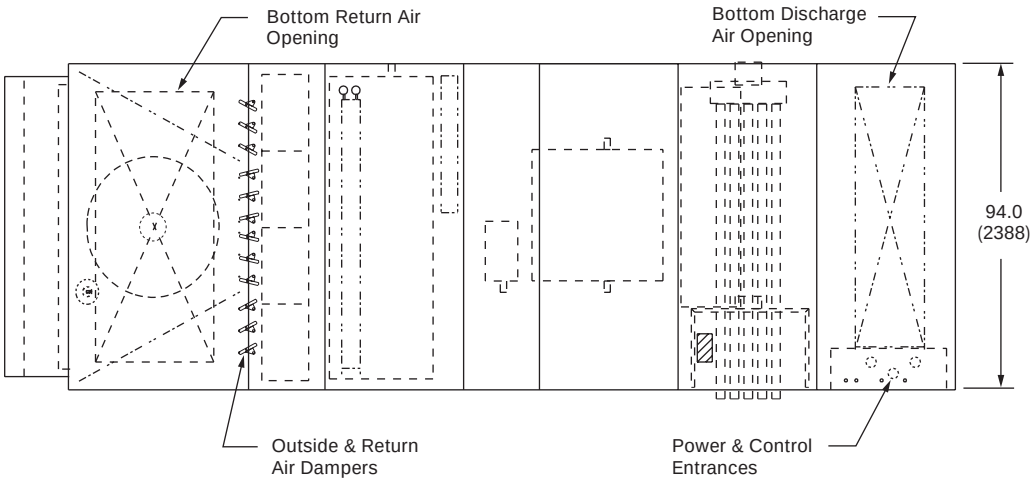
The unit nameplate should be checked to make sure the voltage agrees with the power supply available.

Typical Component Locations

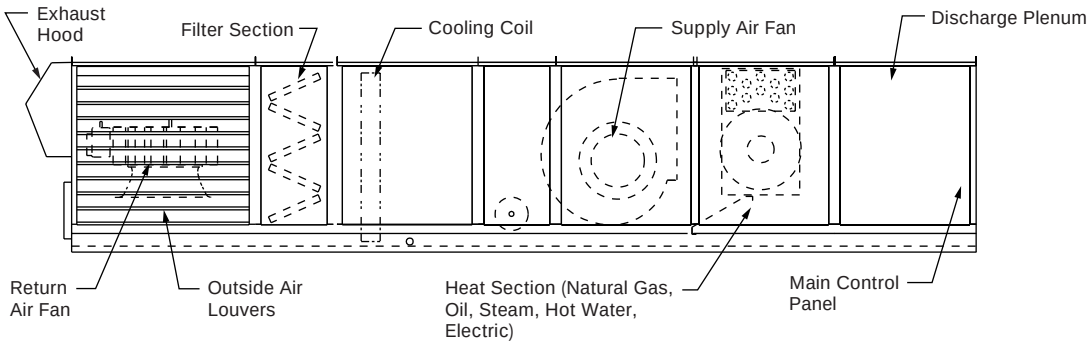
Figure 1 shows a typical RDS unit with the location of the major components and also lists some major dimensions. These figures are for reference only. See the certified submittals for actual specific dimensions.

Figure 1. Typical component locations

Plan View



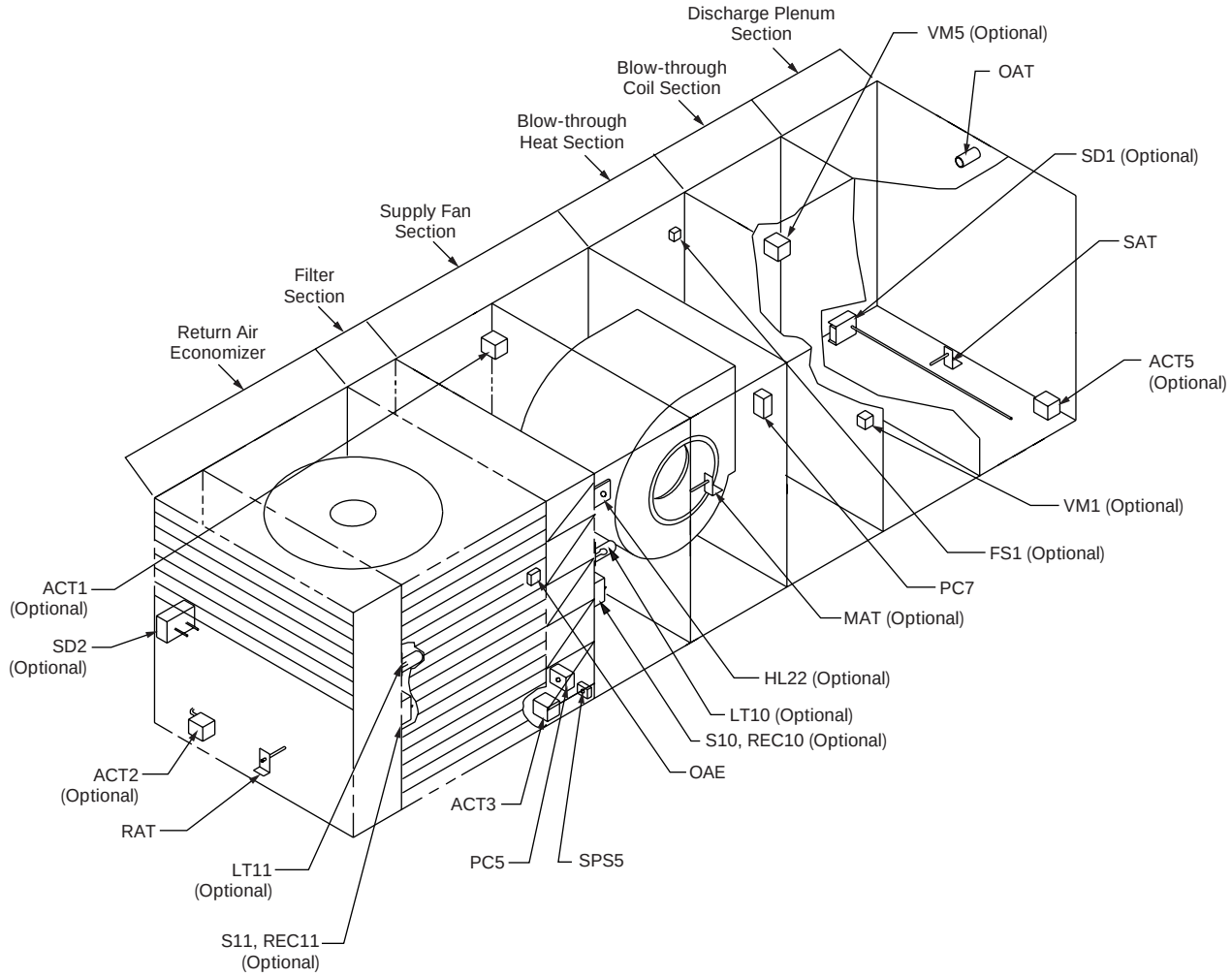
Elevation



Control Locations

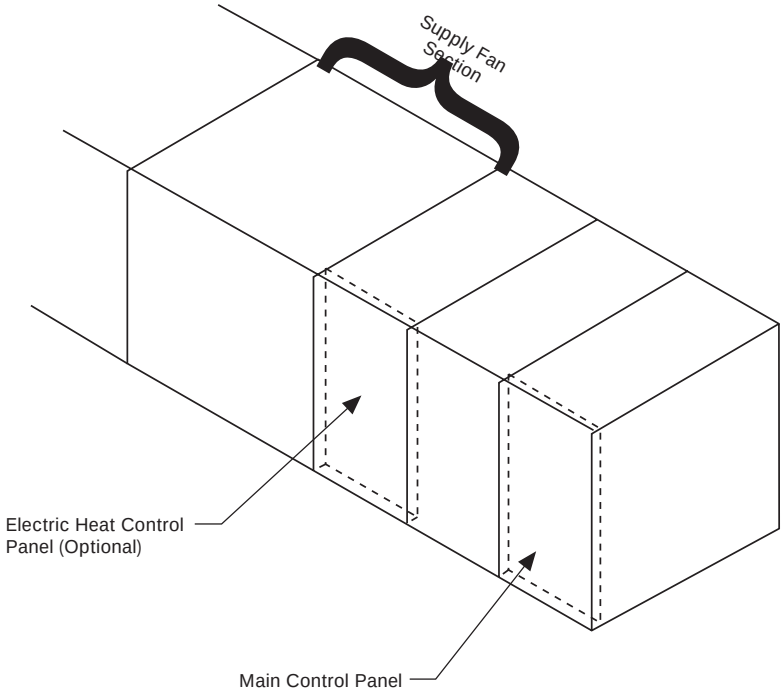
Figure 2 shows the locations of the various control components mounted throughout the unit. See “Control Panel Locations” for the locations of control components mounted in control panels. Additional information is included in Table 2, “Controls, Settings, and Functions,” and the wiring diagram legend which is included in the “Wiring Diagrams” section of this manual.

Figure 2. Control locations

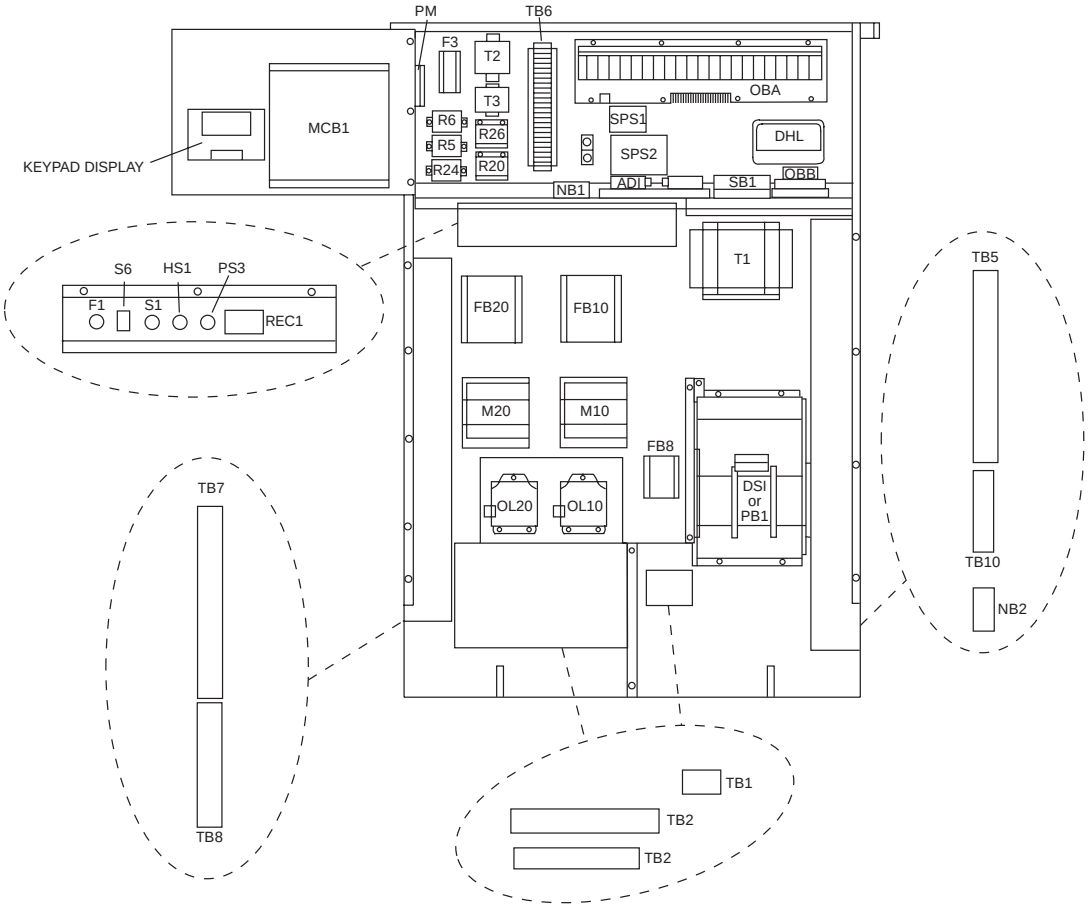


Control Panel Locations

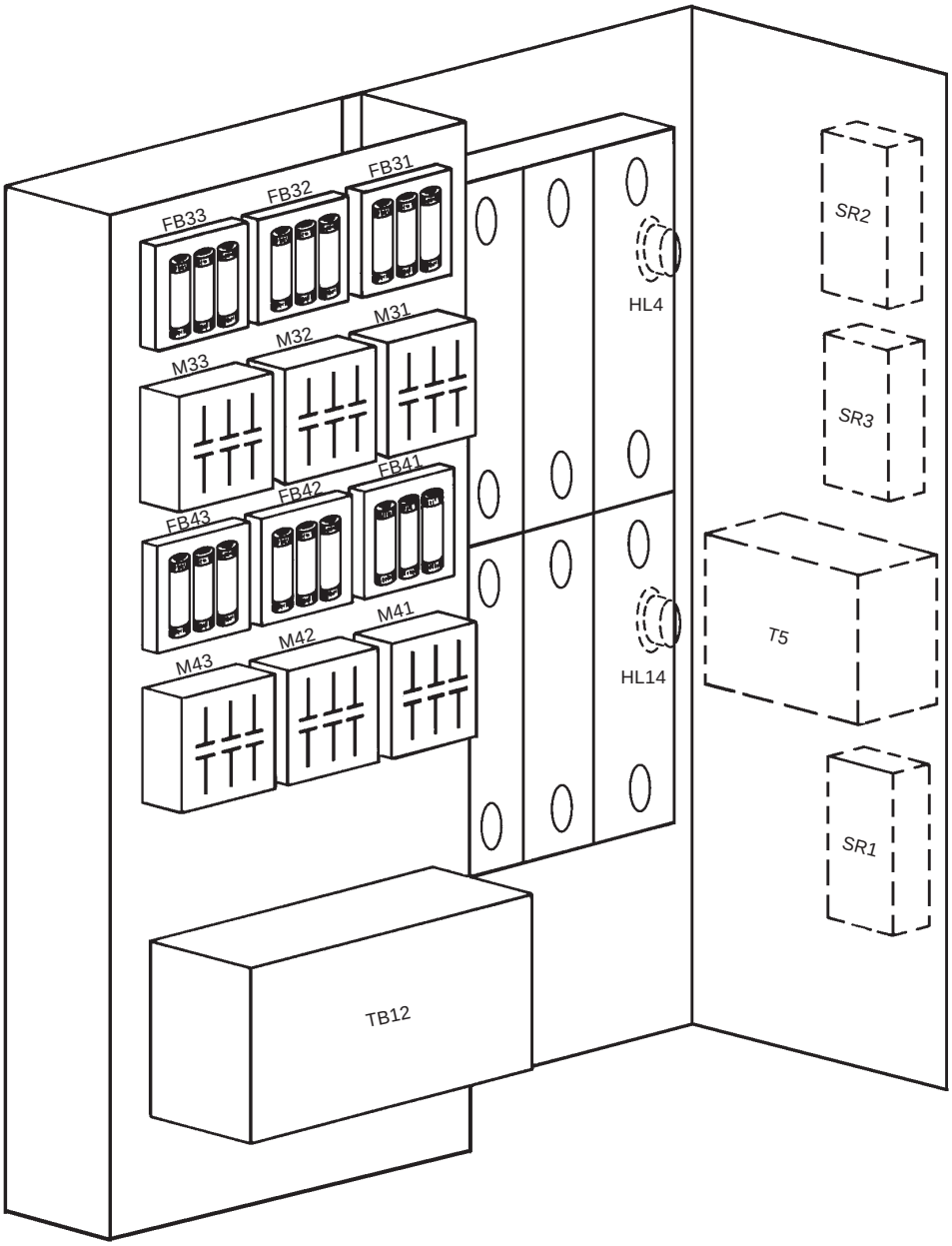
The unit control panels and their locations are shown in the following figures. These figures show a typical unit configuration. Specific unit configurations may differ slightly from these figures depending on the particular unit options.



Main control panel



Electric heat control panel



Controls, Settings, and Functions

Table 2 presents a listing of all the unit control devices. Included in the table are the device symbol, a description of the device, its function, and any reset information, its location, any device setting, any setting ranges, differentials, and the device part number.

Table 2. Controls, settings and functions

SYMBOL	DESCRIPTION	FUNCTION	RESET	LOCATION	SETTING	RANGE	DIFFERENTIAL	PART NO.
ADI	ADI Board	Collects and conditions analog and digital inputs.	N/A	Main control box	N/A	N/A	N/A	658160B-05
DHL	Duct high limit	Prevents excessive VAV duct pressures; shuts off fan.	Auto	Main control box	3.5" w.c. (871.8 Pa)	0.05–5.0" w.c. (12.5–1245.4 Pa)	0.05" w.c. (12.5 Pa), fixed	654938B-01
FS1	Freezestat	Shuts off fans, opens heating valve and closes outdoor damper if low air temperature at coil is detected.	Auto	Heating section	38°F (3°C) or as required	35°F–45°F (2°C–7°C)	12°F (7°C), fixed	658300B-01
MAT	Mixed air temperature sensor	Senses mixed air temperature; sends signal to MicroTech controller.	N/A	Inlet of supply fan	N/A	3K ohms at 77°F (25°C)	N/A	658295B-03
MCB1	Microprocessor Control Board	Processes input information and controls output relays as appropriate.	N/A	Main control box	N/A	N/A	N/A	654873B-08
OAE	Enthalpy control (electromechanical)	Returns outside air dampers to minimum position when enthalpy is too high.	Auto	Economizer section	“B” or as required	A – D	Temperature: 3.5°F (2°C) Humidity: 5% fixed	307067D-02
	Enthalpy control (electronic)	Returns outside air dampers to minimum position when outside air enthalpy is higher than return air enthalpy (used with RAE).	Auto	Economizer section	Fully CW past “D” (when used with RAE)	A – D	N/A	492622B-01
OAT	Outside air temperature sensor	Senses outside air temperature; sends signal to MicroTech controller.	N/A	Under condenser section	N/A	3K ohms at 77°F (25°C)	N/A	658295B-02
OBA, B, C	Output Boards A, B, or C	Holds MicroTech solid-state output relays.	N/A	Main control box	N/A	N/A	N/A	665422B-01: (16-position) 665422B-02: (8-position) 665422B-03: (4-position)
PC5, 6	Filter switch	Turns on clogged filter light on status panel.	Auto	Filter sections	As required	.05–5" w.c. (12.5–1245.4 Pa)	.05" w.c. (12.5 Pa)	654938B-01
PC7	Differential pressure switch	Senses supply fan pressure to prove airflow.	Auto	Supply fan section	.10" w.c. (25 Pa)	.05–5" w.c. (12.5–1245.4 Pa)	.05" w.c. (12.5 Pa), fixed	654938B-01
RAE	Return air enthalpy sensor	Used to compare return air enthalpy to outside air enthalpy (used with OAE).	N/A	Economizer section	N/A	N/A	N/A	492622B-02
RAT	Return air temperature sensor	Senses return air temperature; sends signal to MicroTech controller.	N/A	Return air section	N/A	3K ohms at 77°F (25°C)	N/A	658295B-05
SAT	Supply air temperature sensor.	Senses discharge air temperature; sends signal to MicroTech controller.	N/A	Discharge air section	N/A	3K ohms at 77°F (25°C)	N/A	658295B-01
SB1, 2	Staging Board 1 or 2	Provides stepped cooling or heating control.	N/A	Main control box	N/A	N/A	N/A	See IM 483
SD1	Smoke detector, supply air	Initiates unit shutdown if smoke is detected.	Manual	Discharge air section	N/A	N/A	N/A	490250B-01
SD2	Smoke detector, return air	Initiates unit shutdown if smoke is detected.	Manual	Return air section	N/A	N/A	N/A	490250B-01
SPS1	Duct static pressure sensor #1	Converts static pressure signals to voltage signals and sends them to MicroTech controller.	N/A	Main control box	N/A	0–5" w.c. (0–1245.4 Pa) 1–6 VDC out	N/A	495450B-05
SPS2	Duct static pressure sensor #2	Converts static pressure signals to voltage signals and sends them to MicroTech controller.	N/A	Main control box	N/A	0–5" w.c. (0–1245.4 Pa) 1–6 VDC out	N/A	495450B-05
	Building static pressure sensor	Converts static pressure signals to voltage signals and sends them to MicroTech controller.	N/A	Main control box	N/A	-0.25–0.25" w.c. (-62.3–62.3 Pa) 1–5 VDC out	N/A	495450B-06
SPS5	Dirty filter pressure sensor	Sensors pressure drop across first filter bank and sends signal to MicroTech controller.	N/A	First filter section	N/A	0–5" w.c. (0–1245.4 Pa) 1–6 VDC out	N/A	495450B-05

Continued on next page

Table 2. Controls, settings and functions (continued)

SYMBOL	DESCRIPTION	FUNCTION	RESET	LOCATION	SETTING	RANGE	DIFFERENTIAL	PART NO.
SPS6	Dirty filter pressure sensor	Sensors pressure drop across final filter bank and sends signal to MicroTech controller.	N/A	Final filter section	N/A	0–5" w.c. (0–1245.4 Pa) 1–6 VDC out	N/A	495450B-05
S1	System switch	Shuts off entire control circuit (except crankcase heaters).	N/A	Main control box	N/A	N/A	N/A	013550B-00
TD9, 19	Part winding start timer (fans)	Reduces inrush amp draw on start-up	Auto	Main control box	1 sec., fixed	N/A	N/A	282101D-01
ZNT1, 2, 3	Space temperature sensors	Senses space temperature; sends signal to MicroTech controller.	N/A	In building space	N/A	3K ohms at 77°F (25°C)	N/A	See IM 483
GAS HEATING CONTROLS								
AS	Blower air switch	Proves presence of combustion air.	N/A	Gas furnace control section	0.4" w.c., fixed	N/A	N/A	330038B-00
FD	Flame rod	Senses pilot flame.	N/A	Gas burner assembly	N/A	N/A	N/A	365577A-00
FLC	Fan control	Closes to energize fan when heat exchanger is warm.	Auto	Gas heating section	Closes at 125°F (52°C) Opens at 100°F (28°C)	65°F–220°F (18°C–104°C) 50°F–205°F (10°C–96°C)	25°F (14°C) adjustable	340821B-00
	High limit cutout	Opens furnace control circuit on temperature rise.	Auto	Gas heating section	Opens at 200°F (93°C)	100°F–250°F	25°F (14°C), fixed	
FSG	Flame safeguard	Proves pilot flame and controls main gas valve.	Manual	Gas furnce control section	N/A	N/A	N/A	See IM 684 or 685
GV1	Pilot gas valve	Opens to allow flow of gas to pilot burner.	Normally closed	Gas heating section	N/A	N/A	N/A	344884B-00
GV2, 3	Main gas valves	Open to allow flow of gas to main burner.	Normally closed	Gas heating section	N/A	N/A	N/A	See IM 684 or 685
HL22	Filter high limit control	Opens furnace control circuit on temperature rise.	Manual	Supply air section	Opens at 125°F (52°C)	N/A	25°F (14°C), fixed	479388B-01
HL23	Final filter high limit control	Opens furnace control circuit on temperature rise.	Manual	Final filter section	Opens at 165°F (74°C)	N/A	25°F (14°C), fixed	479388B-04
HPR	High pressure regulator	Regulates pressure to main regulator.	N/A	In gas line before MPR	As specified	10"–13" w.c. (2491–3238 Pa)	N/A	See parts catalog
HP5	High gas pressure switch	Shuts off burner if pressure goes above set point.	Manual	Gas heating section	8" w.c. (1993 Pa)	5"–35" w.c. (1245–8718 Pa)	1"–3" w.c. (249–747 Pa)	See parts catalog
LP5	Low gas pressure switch	Shuts off burner if pressure goes below set point.	Auto	Gas heating section	4" w.c. (996 Pa)	3"–21" w.c. (747–5231 Pa)	1"–3" w.c. (249–747 Pa)	See parts catalog
ELECTRIC HEATING CONTROLS								
HL1, 4 & HL11-14	Secondary heater limit control	Breaks line voltage to heaters if temperatures are too high.	Manual	Electric heat section	Cutout=210°F (99°C)	N/A	N/A	654962B-01
HL31-34 & HL41-44	Primary heater limit control	Breaks control voltage to heat contactor if heater temperatures are too high.	Auto	Electric heat section	Cutout=175°F (79°C) Cutin=145°F (63°C)	N/A	30°F (16°C) fixed	658245B-01
HS1	Switch (toggle), electric heat	Shuts off electric control circuit manually.	N/A	Main control box	N/A	N/A	N/A	237803D-01

The installation of this equipment shall be in accordance with the regulations of authorities having jurisdiction and all applicable codes. It is the responsibility of the installer to determine and follow the applicable codes.

⚠CAUTION

Sharp edges are inherent to sheet metal parts, screws, clips, and similar items. Can cause personal injury.

This equipment is to be installed and operated only by an experienced installation company and fully trained personnel.

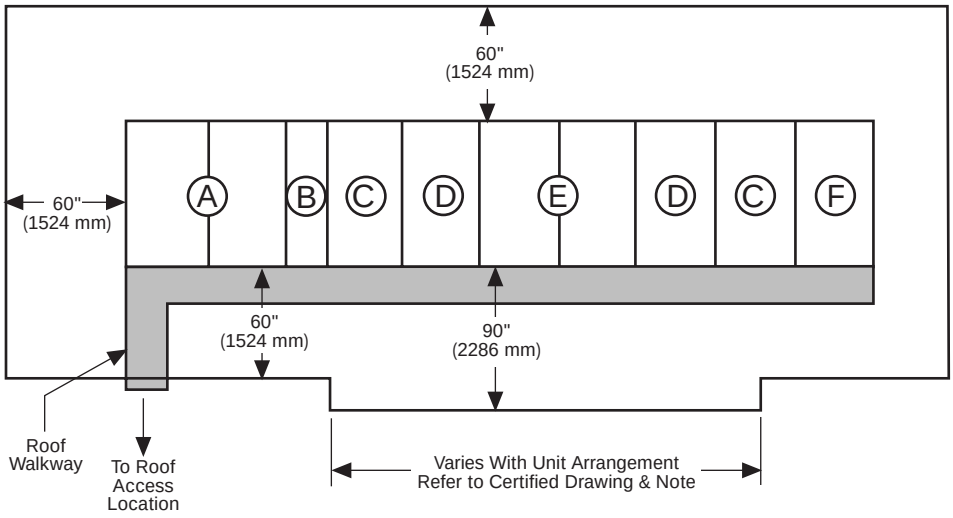
Exercise caution when servicing equipment.

Unit Clearances

Service clearance

Allow service clearance approximately as indicated in figure 3 below. Also, it is recommended that a roof walkway be provided to the rooftop unit and along at least the side of the unit that provides access to most controls and serviceable components.

Figure 3. Service clearance



Legend:
A = Return air section
B = Filter section
C = Coil section
D = Heat section
E = Supply fan section
F = Discharge plenum section

Ventilation clearance

Following are minimum ventilation clearance recommendations. The system designer must consider each application and assure adequate ventilation. If this is not done, the unit will not perform properly.

Unit(s) surrounded by a screen or a fence:

1. The bottom of the screen or fence should be at least 1 ft. (305 mm) above the roof surface.
2. The distance between the unit and the screen or fence should be as described in “Service clearance.”
3. The distance between any two units within the screen or fence should be at least 120" (3048 mm).

Unit(s) surrounded by solid walls:

1. If there are walls on one or two adjacent sides of the unit, the walls may be any height. If there are walls on more than two adjacent sides of the unit, the walls should not be higher than the unit.
2. The distance between the unit and the wall should be at least 96" (2438 mm) on all sides of the unit.
3. The distance between any two units within the walls should be at least 120" (3048 mm).

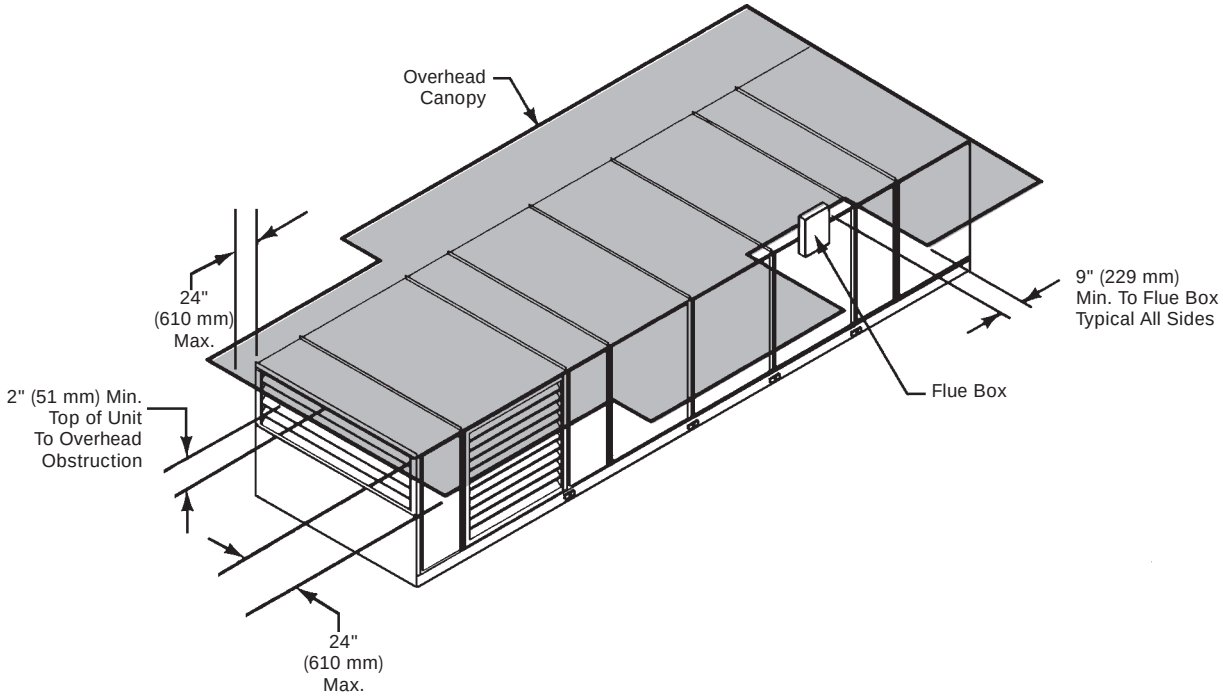
Do not locate outside air intakes near exhaust vents or other sources of contaminated air.

If the unit is installed where windy conditions are common, wind screens should be installed around the unit, maintaining the clearances specified above. This is particularly important to prevent blowing snow from entering outside air intakes.

Overhead clearance

1. Unit(s) surrounded by screens or solid walls shall have no overhead obstructions over any part of the unit.
2. The following restrictions shall be observed for overhead obstructions above the air handler section (see Figure 4):
   a. There shall be no overhead obstructions above the furnace flue, or within 9" (229 mm) of the flue box.
   b. Overhead obstructions shall be no less than 2" (51 mm) above the top of the unit.
   c. There shall be no overhead obstructions in the areas above the outside air and exhaust dampers that are farther than 24" (610 mm) from the side of the unit.

Figure 4. Overhead clearance



Roof Curb Assembly and Installation

The roof curb and unit must be located on a portion of the roof that can support the weight of the unit. The unit must be supported to prevent bending or twisting of the machine.

If building construction could allow the transmission of sound and vibration into the occupied space, it is recommended that the unit be located over a noncritical area. It is the responsibility of the system designer to make adequate provisions for noise and vibration in the occupied space.

The curb and unit must be installed level to allow the condensate drain to flow properly.

Integral supply and return air duct flanges are provided with the RDS roof curb, allowing connection of ductwork to the curb before the unit is set. The gasketed top surface of the duct flanges seals against the unit when it is set on the curb. It is not recommended that these flanges support the total weight of the ductwork. Refer to the “Installing ductwork” section for details on duct connections. It is critical that the condensate drain side of the unit be no higher than the opposite side.

Assembly of a typical RDS roof curb is shown in Figures 5a and 5b. Parts A through H are common to all units having bottom return openings. Depending on the unit length, Parts L and M may be included with the roof curb kit to create the correct overall curb length.

Figure 5a. RDS roof curb assembly instructions

RETURN FAN	"X"		"Y"		"XX"		"YY"	
	IN.	MM	IN.	MM	IN.	MM	IN.	MM
NONE	24.0	610	82.0	2083	6.8	173	1.5	38
(2) 15" FC	24.0	610	82.0	2083	6.8	173	1.5	38
30" AF	30.0	762	76.0	1930	6.8	173	4.5	114
40" AF	36.0	914	78.0	1981	14.8	376	3.5	89

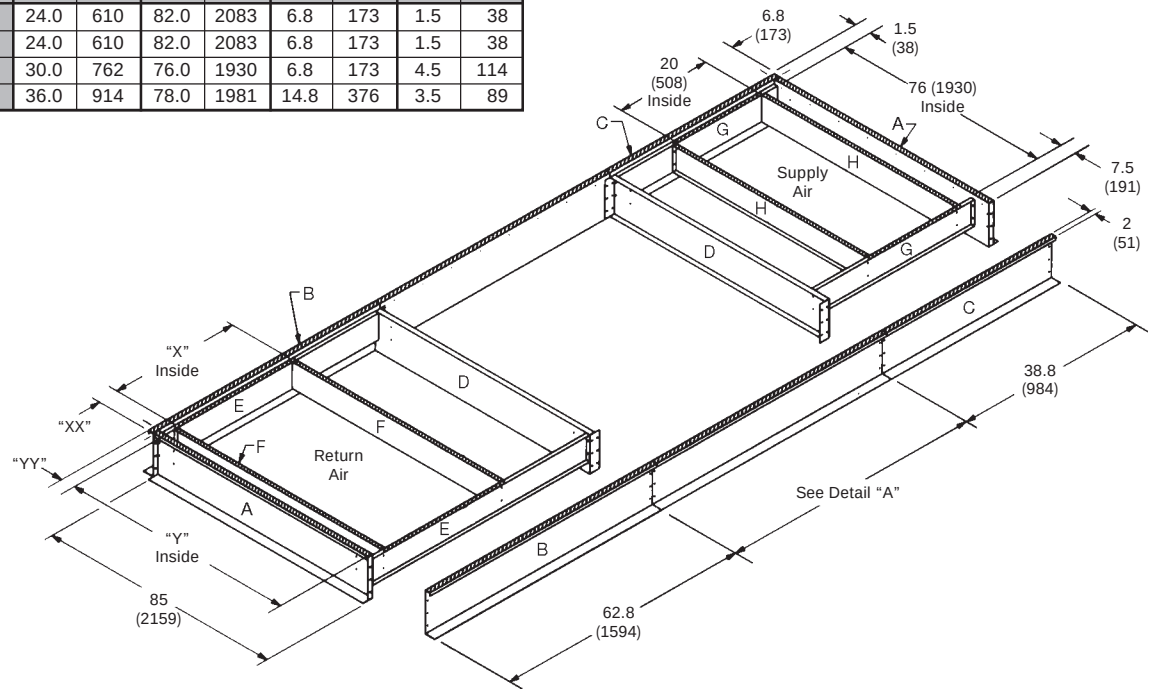
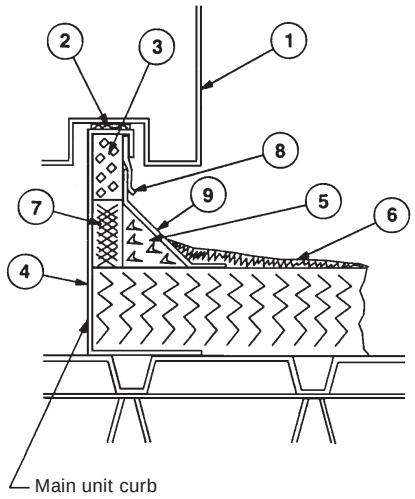


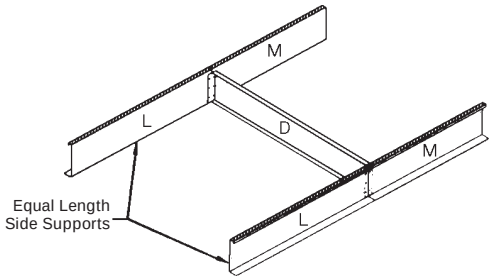
Figure 5b. RDS roof curb assembly instructions



① Unit base
② Curb gasketing
③ 2 x 4 nailer strip
√ Galvanized curb
⑤ Cant strip (not furnished)
≈ Roofing material (not furnished)
Δ Rigid insulation not furnished)
⑧ Counterflashing (not furnished)
⑨ Flashing (not furnished)

Detail "A"

Using remaining side supports in this area, align lengths on opposite sides of assembly and install a cross support "D" at each splice.



Assembly instructions

1. Set curbing parts A through H per dimensions shown over roof opening or on a level surface. Note location of return and supply air openings.
2. If applicable, set other curbing parts (D, L, M, etc.) in place making sure that the orientation agrees with the assembly instructions. Check alignment of all mating bolt holes. See Detail "A".
3. Bolt curbing parts together using fasteners provided. Tighten all bolts finger tight.
4. Square entire curbing assembly and securely tighten all bolts.
5. Position curb assembly over roof openings. Curb must be level from side to side and over its length. Check that top surface of the curb is flat with no bowing or sagging.
6. Weld curbing in place. Caulk all seams watertight. Remove backing from 0.25" (6 mm) thick x 1.50" (38 mm) wide gasketing and apply to surfaces shown by crosshatching.
7. Flash curbing into roof as shown in Detail "B".
8. Parts E and F are not required on units with no return shaft within the curb perimeter.
9. Parts G and H are not required on units with no supply shaft within the curb perimeter.

Post and Rail Mounting

When mounting by post and rail, the structural support should be run the full length of the unit. The structural member should be located at the base of the unit as shown in Figure 6 assuring the shaded area is well supported by the structural member.

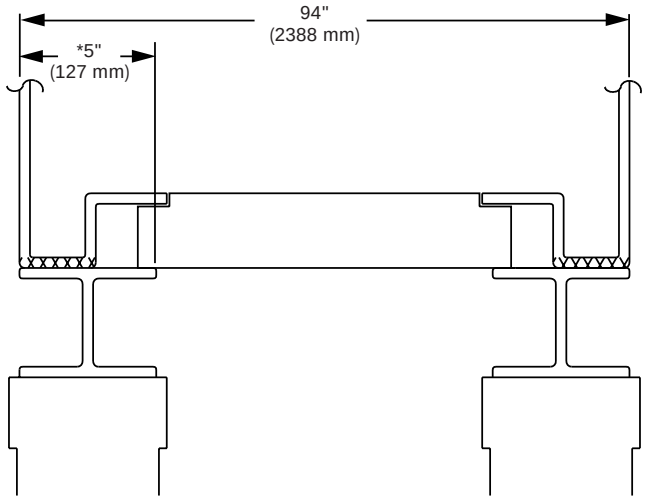
⚠CAUTION

To assure proper system operation, it is important that the unit is mounted level.

The post and rail setup should be done so that the unit is level from side to side and over its entire length.

If resilient material is placed between the unit and the rail, insert a heavy steel plate between the unit and the resilient material to distribute the load. Cabinet penetrations (electrical, piping, etc.) should be sealed in a professional manner to protect against moisture and weather.

Figure 6. Post and rail mounting



*Maximum recommended width for structural member is 5" (127 mm) to allow for adequate space for duct connections and electrical entry.

Rigging and Handling

Lifting brackets with 2" (51 mm) diameter holes are provided on the sides of the unit.

Use spreader bars, 96" to 100" (2438 to 2540 mm) wide to prevent damage to the unit cabinet. Avoid twisting or uneven lifting of the unit. The cable length from the bracket to the hook should always be longer than the distance between the outer lifting points.

If the unit must be stored at the construction site for an intermediate period, set the unit in a reasonably level position with adequate support.

Figure 7 shows an example of the rigging instruction label shipped with each unit.

⚠CAUTION

All lifting points must be used. Adjustment may be required for the middle cable in a 6-cable arrangement.

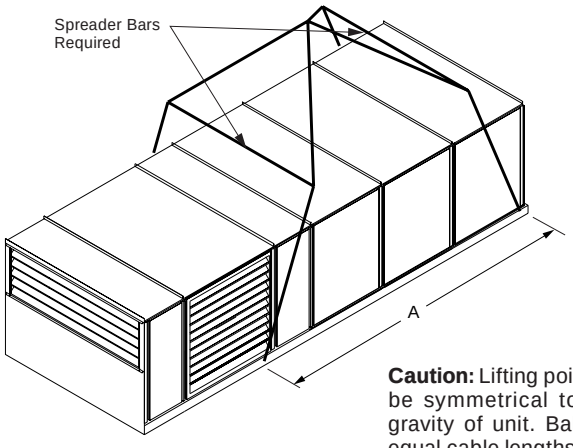
Figure 7. Rigging and handling instruction label

Rigging and Handling Instructions

Unit has either four or six lifting points (four-point shown below).

Caution: **All lifting points must be used.**

Note: Rigging cables must be at least as long as distance “A”.



Caution: Lifting points may not be symmetrical to center of gravity of unit. Ballast or unequal cable lengths may be required.

Lift Only As Indicated

Lifting points

To determine the required lifting cable lengths and whether four- or six-point lifting is required, use Tables 3 and 4 below and Figure 8.

Referring to Figure 8, note that dimension A is the distance between the outer lifting points. The four outer rigging cables must be equal to or longer than dimension A. Dimension B shows the minimum distance between the outer and the inner lifting points for six-point lifting. This can be used to roughly determine the required length of the middle cables for six-point lifting. Dimension A can be determined by subtracting dimensions X and Y from dimension Z (i.e., A = Z – X – Y).

Where:

Z = Total unit length in inches (refer to certified drawings for this dimension).

X = Outdoor/return air section length (refer to Table 3 for this dimension).

If A ≤ 288" (7315 mm), 4-point lifting is sufficient.

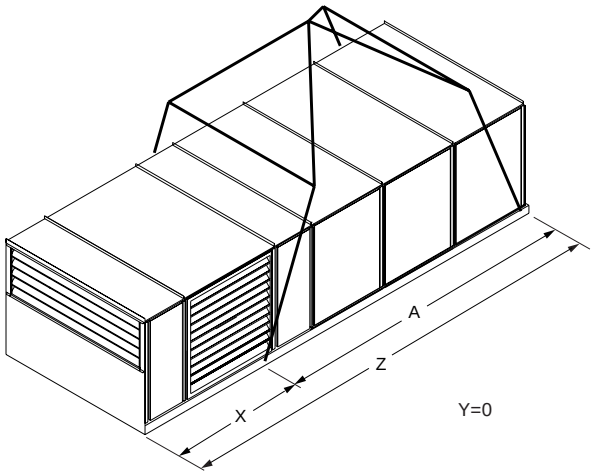
If A > 288" (7315 mm), 6-point lifting is required.

Table 3. "X" dimension (see Figure 8)

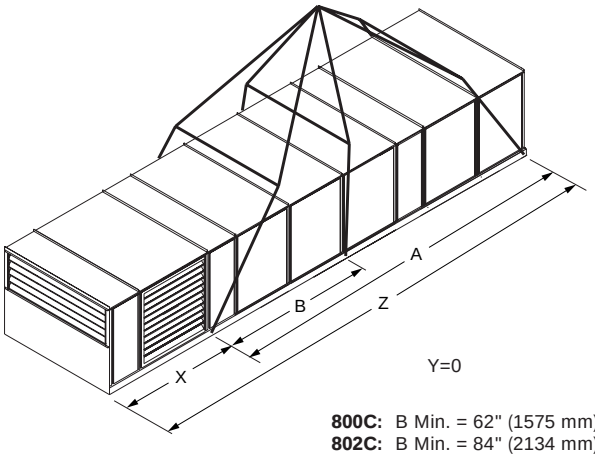
OUTDOOR/RETURN AIR SECTION	800C	802C
100 O.A.	0	0
PLENUM	40" (1016 mm)	52" (1321 mm)
0-30% O.A.	40" (1016 mm)	52" (1321 mm)
0-100% ECONOMIZER	40" (1016 mm)	52" (1321 mm)
0-100% ECONOMIZER WITH 15" RETURN FAN	62" (1575 mm)	—
0-100% ECONOMIZER WITH 30" RETURN FAN	52" (1321 mm)	52" (1321 mm)
0-100% ECONOMIZER WITH 40" RETURN FAN	—	80" (2032 mm)

Figure 8. Unit type RDS

4 lifting points



6 lifting points



800C: B Min. = 62" (1575 mm)
802C: B Min. = 84" (2134 mm)

Installing Ductwork

For bottom discharge and return units not provided with a McQuay roof curb, the installing contractor should make an airtight connection by attaching field fabricated duct collars to the bottom surface of either the roof curb's duct flange or the unit's duct opening. Do not support the total weight of the ductwork fromhe unit or these flanges. Refer to Figure 9.

Units with optional back return, side discharge, or front discharge all have duct collars provided. For back return and front discharge openings, the collars are exposed by removing unit shipping covers. For side discharge units, the duct collar is exposed by removing the plenum section access door and door gasketing.

Flexible connections should be used between the unit and ductwork to avoid transmission of any potential vibration from the unit to the structure.

Ductwork should be designed per ASHRAE and SMACNA recommendations to minimize losses and sound transmission.

Where return air ducts are not required, it is recommended that a sound absorbing T or L section be connected to the unit return to reduce noise transmission to the occupied space.

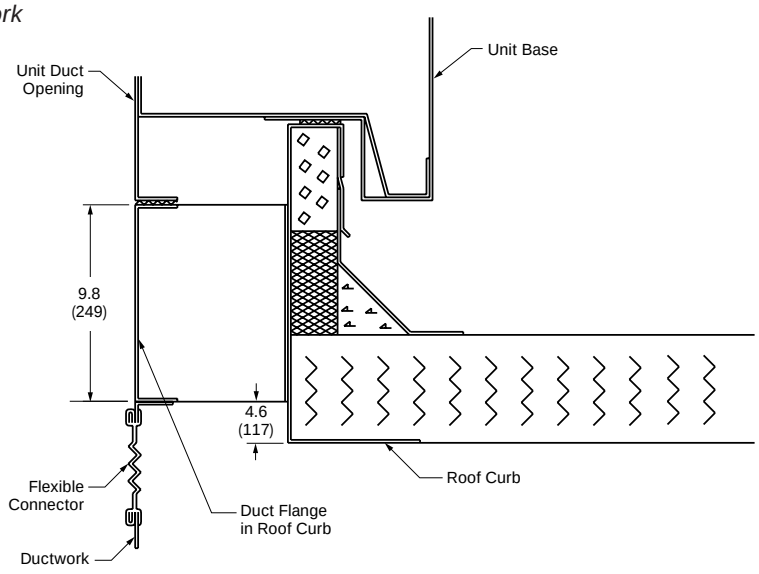
Ductwork exposed to outdoor conditions must be built in accordance with ASHRAE and SMACNA recommendations and local building codes.

NOTICE

On units with side discharge, access to plenum mounted components becomes difficult once ductwork is installed.

Installer must provide access in the ductwork for plenum mounted controls.

Figure 9. Installing ductwork



Installing Duct Static Pressure Sensor Taps

For all VAV units, duct static pressure taps must be field installed and connected to the pressure sensors in the unit. Sensor SPS1 is standard; additional sensor SPS2 is optional. These sensors are located at the back of the unit's discharge plenum (see "Control Panel Locations" in the "Unit Description" section of this manual).

The duct static pressure sensing tap must be carefully located and installed. Improper location or installation of the sensing tap will cause unsatisfactory operation of the entire variable air volume system. Following are pressure tap location and installation recommendations. The installation must comply with local code requirements.

⚠CAUTION

Fragile sensor fittings. May damage pressure sensor.

If tubing must be removed from a pressure sensor fitting, use care. Do not wrench the tubing back and forth to remove or the fitting may break off.

1. Install a tee fitting with a leak-tight removable cap in each tube near the sensor. This will facilitate connecting a manometer or pressure gauge if testing is required.
2. Use different colored tubing for the duct pressure (HI) and reference pressure (LO) taps, or tag the tubes.
3. Locate the duct pressure (HI) tap near the end of a long duct to ensure that all terminal box takeoffs along the run will have adequate static pressure.
4. Locate the duct tap in a nonturbulent flow area of the duct. Keep it several duct diameters away from takeoff points, bends, neckdowns, attenuators, vanes, or other irregularities.
5. Use a static pressure top (Dwyer A302 or equivalent) or the bare end of the plastic tubing for the duct tap. (If the duct is lined inside, use a static pressure tip device.)
6. Install the duct tap so that it senses only static pressure (not velocity pressure). If a bare tube end is used it must be smooth, square (not cut an angle), and perpendicular to the airstream (see Figure 10).
7. Locate the reference pressure (LO) tap somewhere near the duct pressure tap within the building (see Figure 10). If the reference tap is not connected to the sensor, unsatisfactory operation will result.
8. Route the sensing tubes to the sensor(s) mounted on the

back wall of the discharge plenum. Sensing tubes should enter the unit discharge plenum through the main supply duct trunk. Make sure that duct penetrations are sealed and that tubing is protected by rubber grommets. Carefully connect the HI and LO tubes to the appropriate sensor fittings.

Figure 10. Duct static pressure tap installation

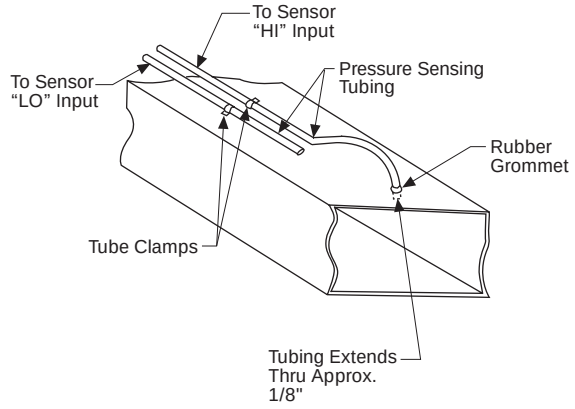
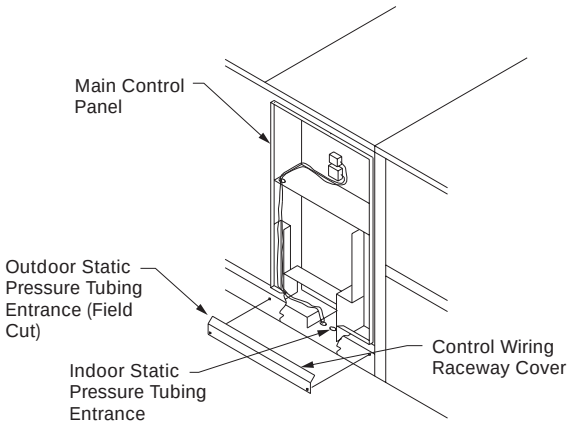


Figure 11. Static pressure tubing entrance locations



Installing Building Static Pressure Sensor Taps

If a unit has direct building static pressure control capability, static pressure taps must be field installed and connected to pressure sensor SPS2 in the unit. This sensor is located at the back of the discharge section (see "Control Panel Locations" in the "Unit Description" section of this manual).

The two static pressure sensing taps must be carefully located and installed. Improper location or installation of the sensing taps will cause unsatisfactory operation. Following are pressure tap location and installation recommendations for both building envelope and lab, or "space within a space," pressure control applications. The installation must comply with local code requirements.

⚠CAUTION

Fragile sensor fittings. May damage pressure sensor.

If tubing must be removed from a pressure sensor fitting, use care. Do not wrench the tubing back and forth to remove or the fitting may break off.

Building pressurization applications

1. Install a tee fitting with a leak-tight removable cap in each tube near the sensor. This will facilitate connecting a manometer or pressure gauge if testing is required.
2. Locate the duct pressure (HI) tap in the area that requires the closest control. Typically, this is a ground level floor that has doors to the outside.
3. Locate the building tap so that it is not influenced by any source of moving air (velocity pressure). These sources may include air diffusers or outside doors.
4. Route the building tap tube to sensor SPS2 mounted on the back wall of the discharge plenum. Sensing tube should enter the unit discharge plenum through the main supply duct trunk. Make sure that duct penetration is sealed and that tubing is protected by a rubber grommet. Carefully connect to the HI sensor fitting.
5. Locate the reference pressure (LO) tap on the roof. Keep it away from the condenser fans, walls, or anything else that may cause turbulence. Mount it high enough above the roof so that it is not affected by snow. If the reference tap is not connected to the sensor, unsatisfactory operation will result.
6. Use an outdoor static pressure tip (Dwyer A306 or equivalent) to minimize the adverse effects of wind. Place some type of screen over the sensor to keep out insects. Loosely packed cotton works well.
7. Route the outdoor tap tube to sensor SPS2 mounted on the back wall of the discharge plenum. Sensing tube should enter the unit discharge plenum through a hole cut in the back wall of the discharge plenum. Make sure that the penetration is sealed and that tubing is protected by a rubber grommet. Carefully connect to the LO sensor fitting.

Lab pressurization applications

1. Install a tee fitting with a leak-tight removable cap in each tube near the sensor. This will facilitate connecting a manometer or pressure gauge if testing is required.
2. Use different colored tubing for the controlled space pressure (HI) and reference pressure (LO) taps, or tag the tubes.
3. Regardless of whether the controlled space is positive or negative with respect to its reference, locate the HI pressure tap in the controlled space. (The set point can be set between –0.2" and 0.2" w.c.)
4. Locate the reference pressure (LO) tap in the area surrounding the controlled space. If the reference tap is not connected to the sensor, unsatisfactory operation will result.
5. Locate both taps so that they are not influenced by any source of moving air (velocity pressure). These sources may include air diffusers or doors between the high and low pressure area.
6. Route the tap tubes between the curb and the supply duct, and feed them into the unit through the knockout in the bottom of the control panel (see Figure 11).
7. Connect the tubes to the appropriate ¼" fittings on sensor SPS2. Assure that the sensor does not support the weight of the tubing; use tube clamps or some other means.

Condensate Drain Connection

The unit is provided with a 1.5" male NPT condensate drain connection. Refer to certified drawings for the exact location. The unit and drain pan must be level side to side and a P-trap must be installed for proper drainage.

RDS units may have positive or negative pressure sections. It is recommended that traps be used in both cases with care given to negative pressure sections. In Figure 12, dimension A should be a minimum of 8" (203 mm). As a conservative measure to prevent the cabinet static pressure from blowing or drawing the water out of the trap and causing air leakage, dimension A should be two times the maximum static pressure encountered in the coil section in inches w.c.

Drainage of condensate directly onto the roof may be acceptable; refer to local codes. It is recommended that a small drip pad of either stone, mortar, wood or metal be provided to protect the roof against possible damage.

If condensate is to be piped into the building drainage system, the drain line should be pitched away from the unit at a minimum of ⅛" per foot. The drain line must penetrate the roof external to the unit. Refer to local codes for additional requirements. Sealed drain lines require venting to assure proper condensate flow.

Where the cooling coils have intermediate condensate pans on the face of the evaporator coil, copper tubes near both ends of the coil provide drainage to the main drain pan. Check that the copper tubes are in place and open before the unit is put into operation.

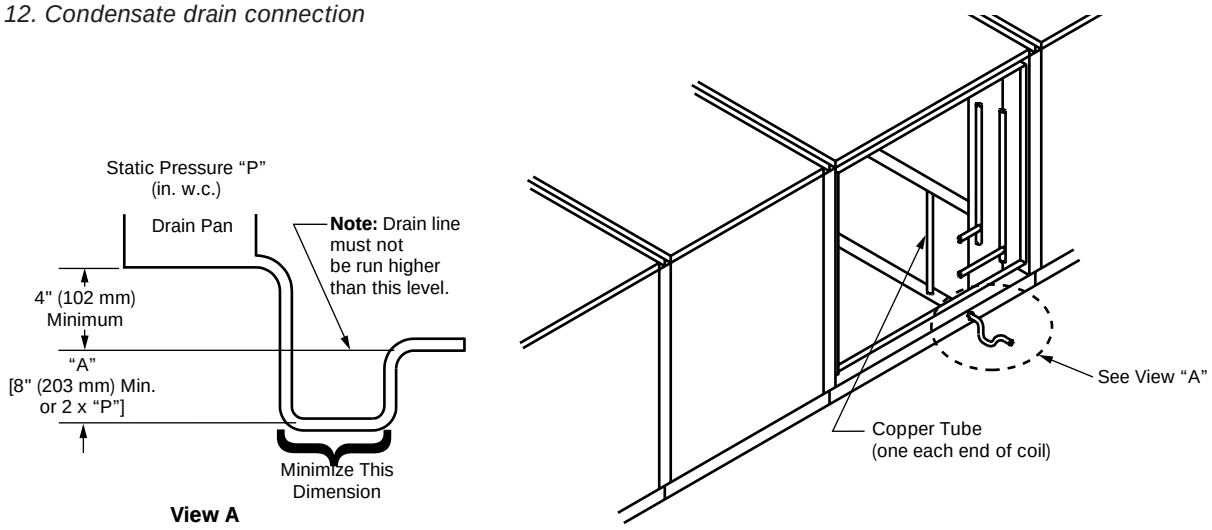
Because drain pans in any air conditioning unit will have some moisture in them, algae, etc. will grow. Periodic cleaning is necessary to prevent this buildup from plugging the drain and causing the drain pan to overflow. Also, the drain pans should be kept clean to prevent the spread of disease. Cleaning should be performed by qualified personnel.

⚠WARNING

Biological hazard. May cause disease.

Cleaning should be performed by qualified personnel.

Figure 12. Condensate drain connection



Field Refrigerant Piping and Charging of DX Coils

RDS units that ship from the factory with DX coils installed do not include refrigerant piping or refrigerant controls. The coil assembly is ready for field connections at the distributors and at the suction headers. Piping kits that provide the necessary liquid and hot gas piping and control components are available for field installation.

Field installed refrigerant piping may exit the unit cabinet at one of the following locations:

1. Through the floor of the unit.
2. Through the discharge and bulkhead of the unit.
3. Through a cabinet door near the DX coil that is not required for service areas.

Caution: For any of the above cabinet penetrations, the hole must be tightly sealed to prevent water or air leakage.

In preparing for field piping, the plastic plugs on the distributor must be removed and the copper caps at the suction header connections must be unsweated.

Piping design, sizing and installation information presented in the "ASHRAE Handbooks" should be followed in the design and installation of interconnecting piping. The RDS and condensing units are intended to be set at the same elevation as close as possible to each other to minimize refrigerant pressure drop. The piping must be designed and installed to prevent liquid refrigerant carryover to the compressor and to assure a continuous return of compressor oil from the system.

⚠CAUTION

The pounds of refrigerant in the system may exceed the capacity of the condenser, depending on the amount of refrigerant in the liquid lines between the DX coil and the condensing unit. Refer to condenser manufacturer for information about refrigerant capacity. Suitable means of containing the refrigerant is required.

⚠WARNING

On systems with optional hot gas bypass, it is important that the bypass solenoid valve be located at the condensing unit and not at the DX coil to prevent liquid return and damage to the compressor.

Piping recommendations

1. Use type K or L clean copper tubing. All joints should be thoroughly cleaned or brazed with high temperature solder.
2. Piping sizes should be based on temperature/pressure limitations as recommended in the following paragraphs. Under no circumstances should pipe size be based strictly upon coil or condensing unit piping connection size.
3. Suction line piping pressure drop should not exceed the pressure equivalent of 2°F (1°C), 3 psi (20.7 kPa) per 100 feet (30.5 m) of equivalent pipe length. After the suction line size has been determined, the vertical suction risers should be checked to verify that oil will be carried up the riser and back to the compressor. The suction line(s) should be pitched in the direction of refrigerant flow and adequately supported. Lines should be free draining and fully insulated between the evaporator and the compressor.
4. Vertical suction risers should be checked using Table 4 to determine the minimum tonnage required to carry oil up suction risers of various sizes.
5. The liquid line should be sized for a pressure drop not to exceed the pressure equivalent of 2°F (1°C), 6 psi (41.4 kPa) saturated temperature. The RDS unit includes a factory installed filter-drier, solenoid valve, and sightglass in each liquid line, upstream of the thermostatic expansion valve.

Table 4. Minimum tonnage (R-22) to carry oil up suction riser at 40°F saturated suction

LINE SIZE O.D.	1⅛"	1⅜"	1⅝"	2⅛"	2⅝"	3⅛"	3⅝"	4⅛"
MINIMUM TONS	1.50	2.50	3.80	7.60	13.10	20.4	29.7	41.3

Note: When compressor minimum tonnage is less than shown in the above table for a given line size, double suction risers will be required.

Leak testing

The field piping system should be checked for leaks prior to charging. Leak testing must be performed to current EPA standards and regulations. After making any necessary repair, the system should be evacuated as described in the following paragraphs.

⚠WARNING

Do not use oxygen to build up pressure.

A serious explosion could result from using oxygen to build up pressure, resulting in severe personal injury or death.

Evacuation

After it has been determined that the unit is tight and there are no refrigerant leaks, the system should be evacuated. The use of a vacuum pump with a pumping capacity of approximately 3 cu.ft./min. and the ability to reduce the vacuum in the unit to at least 1 millimeter (1000 microns) is recommended.

1. A mercury manometer or an electronic or other type of micron gauge should be connected to the unit at a point remote from the vacuum pump. For readings below 1 millimeter, an electronic or other micron gauge should be used.
2. The triple evacuation method is recommended and is particularly helpful if the vacuum pump is unable to obtain the desired 1 millimeter of vacuum. The system is first evacuated to approximately 29" (740 mm) of mercury. Enough refrigerant vapor is then added to the system to bring the pressure up to 0 pounds (0 microns).
3. Then the system is once again evacuated to 29" (740 mm) of vacuum. This procedure is repeated three times. This method can be most effective by holding system pressure at 0 pounds (0 microns) for a minimum of 1 hour between evacuations. The first pulldown will remove about 90% of the noncondensables, the second about 90% of that remaining from the first pulldown, after the third, only 1/10 of 1% of noncondensables will remain.

Table 5 below shows the relationship between pressure, microns, atmospheres, and the boiling point of water.

Table 5. Pressure-vacuum equivalents

ABSOLUTE PRESSURE ABOVE ZERO		VACUUM BELOW 1 ATMOSPHERE		APPROXIMATE FRACTION OF 1 ATMOSPHERE	BOILING POINT OF H_2O AT EACH PRESSURE (°F)
MICRONS	PSIA	MERCURY (MM)	MERCURY (IN.)		
0	0	760.00	29.921	—	—
50	0.001	759.95	29.920	1/15,200	–50
100	0.002	759.90	29.920	1/7,600	–40
150	0.003	759.85	29.920	1/5,100	–33
200	0.004	759.80	29.910	1/3,800	–28
300	0.006	759.70	29.910	1/2,500	–21
500	0.009	759.50	29.900	1/1,520	–12
1,000	0.019	759.00	29.880	1/760	1
2,000	0.039	758.00	29.840	1/380	15
4,000	0.078	756.00	29.760	1/189	29
6,000	0.117	754.00	29.690	1/127	39
8,000	0.156	752.00	29.600	1/95	46
10,000	0.193	750.00	29.530	1/76	52
15,000	0.290	745.00	29.330	1/50	63
20,000	0.387	740.00	29.130	1/38	72
30,000	0.580	730.00	28.740	1/25	84
50,000	0.967	710.00	27.950	1/15	101
100,000	1.930	660.00	25.980	2/15	125
200,000	3.870	560.00	22.050	1/4	152
500,000	9.670	260.00	10.240	2/3	192
760,000	14.697	0	0	1 Atmosphere	212

Charging the system

1. After all refrigerant piping is complete and the system has been evacuated, it can be charged as described in the paragraphs following. Connect the refrigerant drum to the gauge port on the liquid shutoff valve, and purge the charging line between the refrigerant cylinder and the valve. Then open the valve to the midposition.
2. If the system is under a vacuum, stand the refrigerant drum with the connection up, open the drum and break the vacuum with refrigerant gas.
3. With a system gas pressure higher than the equivalent of a freezing temperature, invert the charging cylinder and elevate the drum above the condenser. With the drum in this position and the valves open, liquid refrigerant will flow into the condenser. Approximately 75% of the total requirement estimated for the unit can be charged in this manner.
4. After 75% of the required charge has entered the condenser, reconnect the refrigerant drum and charging line to the suction side of the system. Again purge the connecting line, stand the drum with the connection side up, and place the service valve in the open position.

Important: At this point, the charging procedure should be interrupted and prestart checks made before attempting to complete the refrigerant charge.

Note: It is recommended that the total operating charge per circuit be stamped on the unit nameplate for future reference.

Refrigerant charge

Factory installed DX coils in RDS units are designed for use with R-22. The total charge per circuit is the sum of three values:
1. Condensing unit charge — refer to manufacturer's data.
2. Evaporator coil charge — refer to Table 6.
3. Charge for length of interconnecting piping, *installed by field* — refer to Table 7.

Note: The systems consist of one refrigerant circuit on unit size 800C and two refrigerant circuits containing identical weights of refrigerant on unit size 802C. The values shown in Tables 6 and 7 are for *each* circuit.

Note: The total operating charge per circuit should not exceed the pumpdown capacity per circuit, specified by the condensing unit manufacturer.

Table 6. Approximate refrigerant charge per circuit

UNIT SIZE	EVAPORATOR COIL (LBS/CKT/COIL ROW)
800C	3.30
802C*	2.45

*The RDS 802C unit has two refrigerant circuits.

Table 7. Weight of refrigerant R-22 in copper lines (pounds per 100 feet of Type L tubing)

O.D. LINE SIZE	VOL. PER 100 FT. IN CUBIC FEET	WEIGHT OF REFRIGERANT, LBS./100 FEET			
		LIQUID @ 100°F	HOT GAS @120°F COND.	SUCTION GAS (SUPERHEAT TO 85°F)	
				20°F	40°F
⅜"	0.054	3.84	0.202	0.052	0.077
½"	0.100	7.12	0.374	0.098	0.143
⅝"	0.162	7.12	0.605	0.158	0.232
⅞"	0.336	24.00	1.260	0.323	0.480
1⅛"	0.573	40.80	2.140	0.550	0.820
1⅜"	0.872	62.10	3.260	0.839	1.250
1⅝"	1.237	88.00	4.620	1.190	1.770
2⅛"	2.147	153.00	8.040	2.060	3.060
2⅝"	3.312	236.00	12.400	3.180	4.720
3⅛"	4.728	336.00	17.700	4.550	6.750
3⅝"	6.398	456.00	24.000	6.150	9.140
4⅛"	8.313	592.00	31.100	8.000	11.190

Unit Piping

Gas piping

See the "Installation" section of the gas-fired furnace installation manual, Bulletin No. IM 684 or 685.

Fuel oil piping

See the "Installation" section of the forced draft oil-fired furnace installation manual, Bulletin No. IM 198.

Contractor coil piping

Contractor coils have fin height no greater than 36" (914 mm). Coil connections are on the same side of the unit opposite the drive. Refer to Table 8 for threaded connection sizes for chilled water, hot water, and steam coils. Evaporator coil connection sizes are based on the specific distributor and nozzle size selected for the given design conditions. See the MS-85 Coil Selection Program output for sweat connection information.

Table 8. Contractor coil connections based on fin height

CONTRACTOR COIL		CONNECTION SIZE		
		1.50 NPT	2.00 NPT	2.50 NPT
CHILLED WATER	5WH, 5MH	12-36	—	—
	5WL	12-18	21-30	33-36
	5WS, 5MS	12-18	21-30	33-36
	5WM, 5WD	—	—	12-36
EVAPORATOR	5E*	See MS-85 Coil Selection Output		
HOT WATER	5W*, 1-Row	12-36	—	—
STEAM	5GA, 5JA–1-Row	—	12-36	—
	5GA, 5JA–2-Row	—	—	12-36
	8GA, 8JA	—	—	12-36

Unit coil piping

Chilled water

Unit chilled water coils have a fin height of 48" (1219 mm). A factory installed three-way valve, piping and motor actuator is available for chilled water coils provided in a cooling only section (see Figure 13). When no factory piping or valve is included, coil connections are 2.50" male NPT copper. With the factory valve package, field connections are the same NPT as the valve with female threading. **Note:** The valve actuator spring returns to a stem up position upon power failure. This allows full flow through the coil.

Figure 13. Three-way valve package

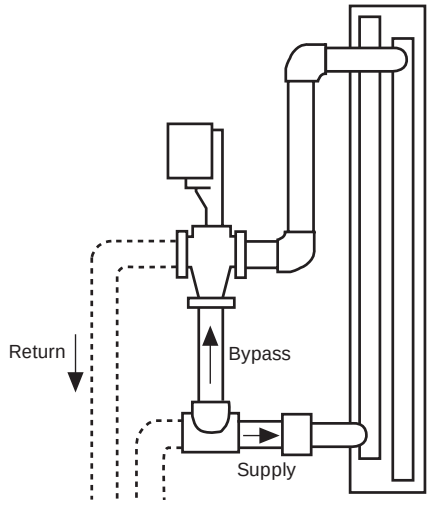
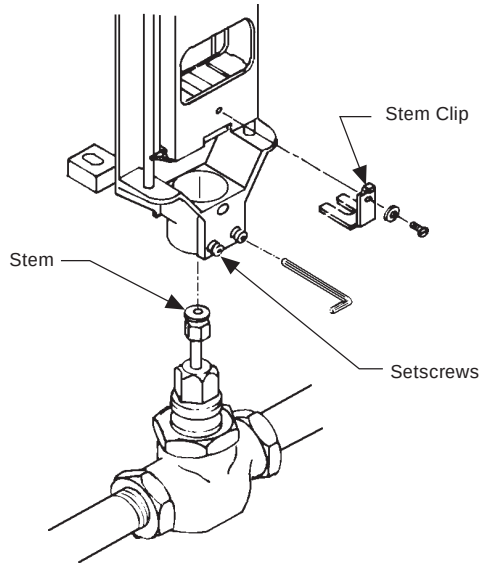


Figure 14. Valve assembly



Evaporator

Unit evaporator coils have a fin height of 48" (1219 mm). Table 9 provides field sweat connection information for evaporator coils.

Table 9. Unit DX connections

UNIT DX COIL	CONNECTION SIZE (IN.)	
	LIQUID	SUCTION
RDS 800C	1.375 ODM	2.125 ODS
RDS 802C	1.125 ODM	1.625 ODS

Hot water

Note: If the unit is equipped with an iron valve, connecting to a copper piping system will likely cause galvanic corrosion to occur and the valve will not last. All coils have vents and drains factory installed.

Hot water coils are not normally recommended for use with entering air temperatures below 40°F (4°C). No control system can guarantee a 100% safeguard against coil freeze-up. Glycol solutions or brines are the only freeze-safe media for operation of water coils at low entering air temperature conditions.

Unit hot water coils have a fin height of 39" (991 mm). A factory installed three-way valve, piping and motor actuator is available for hot water coils in a heating only section (see Figure 13). When no factory piping or valve is included, the coil connections are 1.625" ODM copper. With the factory valve package, field connections are the same NPT as the valve with female threading.

Note: The valve actuator spring returns to a stem down position upon power failure. This allows full flow through the coil.

⚠WARNING

Coil freeze possible. May damage equipment.

Carefully read instruction for mixing antifreeze solution used. Some products will have higher freezing points in their natural state than when mixed with water. The freezing of coils is not the responsibility of McQuay International. Refer to “Winterizing Coils” in the “Maintenance” section of this manual.

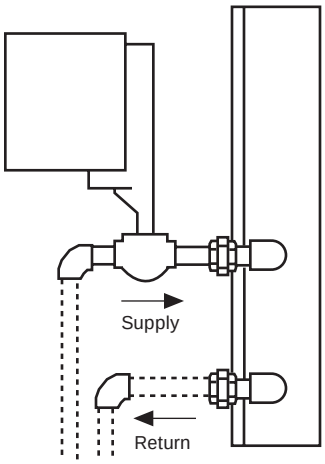
Steam

Unit steam coils have a fin height of 39" (991 mm). A factory installed two-way valve, piping and motor actuator is available for steam coils in a heating only section (see Figure 15). When no factory piping or valve is included, the coil connections are 2.50" MPT iron pipe. With the factory valve package, field connections are the same NPT as the valve with female threading.

Note: The valve actuator spring returns to a stem up position upon power failure. This allows full flow through the coil.

Steam piping recommendations

Figure 15. Two-way valve package



1. Be certain that adequate piping flexibility is provided. Stresses resulting from expansion of closely coupled piping and coil arrangement can cause serious damage.

2. Do not reduce pipe size at the coil return connection. Carry return connection size through the dirt pocket, making the reduction at the branch leading to the trap.
3. It is recommended that vacuum breakers be installed on all applications to prevent retaining condensate in the coil. Generally, the vacuum breaker is to be connected between the coil inlet and the return main. However, if the system has a flooded return main, the vacuum breaker should be open to the atmosphere and the trap design should allow venting of the large quantities of air.
4. Do not drain steam mains or takeoffs through coils. Drain mains ahead of coils through a steam trap to the return line.
5. Do not attempt to lift condensate.
6. Pitch all supply and return steam piping down a minimum of 1" (25 mm) per 10 feet (3 m) of direction of flow.

Steam trap recommendations

1. Size traps in accordance with manufacturers' recommendations. Be certain that the required pressure differential will always be available. Do not undersize.
2. Float and thermostatic or bucket traps are recommended for low pressure steam. Use bucket traps on systems with on-off control only.
3. Locate traps at least 12" (305 mm) below the coil return connection.
4. Always install strainers as close as possible to the inlet side of the trap.
5. A single tap may generally be used for coils piped in parallel, but an individual trap for each coil is preferred.

Steam coil freeze conditions

If the air entering the steam coil is below 35°F (2°C), note the following recommendations:

1. 5 psi (34.5 kPa) steam must be supplied to coils at all times.
2. Modulating valves are not recommended. Control should be by means of face and bypass dampers.
3. As additional protection against freeze-up, the tap should be installed sufficiently far below the coil to provide an adequate hydrostatic head to ensure removal of condensate during an interruption on the steam pressure. Estimate 3 ft. (914 mm) for each 1 psi (7 kPa) of trap differential required.
4. If the unit is to be operated in environments with possible freezing temperatures, an optional freezestat is recommended. Refer to "Freeze Protection" in the "Unit Options" section of this manual.

Coil piping vestibule

When a unit coil is installed in a heating only or cooling only section (including the draw-through cooling/supply air fan section on the RDS 800C), all piping may be done internal to the unit without requiring a piping vestibule.

For all contractor coils and all unit coils installed in a combination coil section, the coil connections project to the inside surface of the door panel. Holes may be cut in the door panels for the piping to be connected to the coils, or an accessory piping vestibule may be added to the unit to provide piping space. Refer to the section on vestibule assembly instructions. The piping may then be routed back within the unit.

To avoid piping penetrations through the roof external to the curb, holes may be cut through the floor of the unit at the locations specified on the certified drawings. ***Caution:*** All holes in the unit floor must be sealed to prevent water leakage into the building.

Vestibule Assembly Instructions

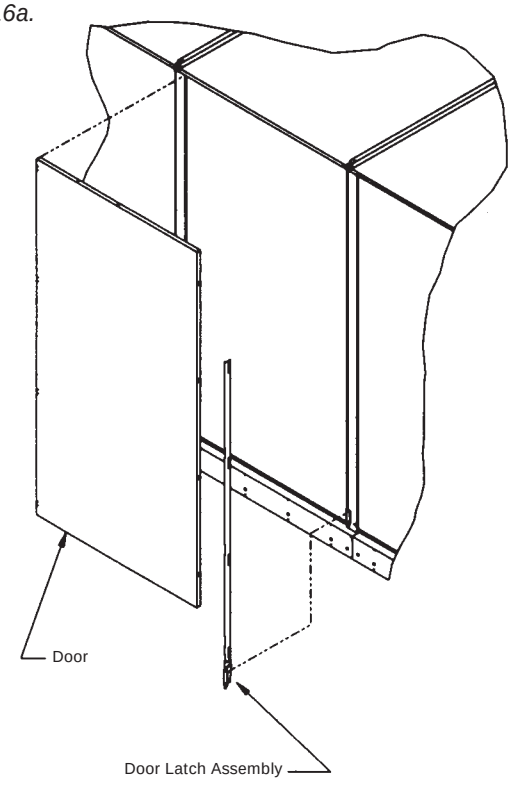
An accessory vestibule is available to provide additional piping space for coils installed in a 40" (1016 mm) section. A vestibule is required to maintain door access on a combination heating and cooling section. The vestibule should be assembled to the unit part by part as shown in Figures 16a through 16d. **Note:** The door, hinge, and latch assemblies from the unit are used on the vestibule.

Step 1

Remove door from section where vestibule is to be located by removing screws holding hinges to upright support (leave hinges on door). Set door aside and save for Step 4.

Remove door latch assembly or a wrench to remove screws holding latch assembly in place. Save door latch assembly, screws and bushings for Step 4.

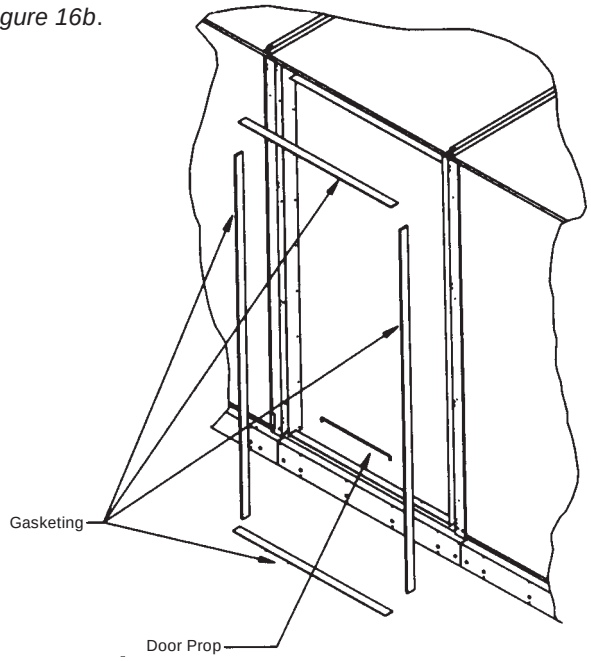
Figure 16a.



Step 2

Remove gasketing around door flange and save for use on vestibule. See Step 4. Remove door and save for Step 4.

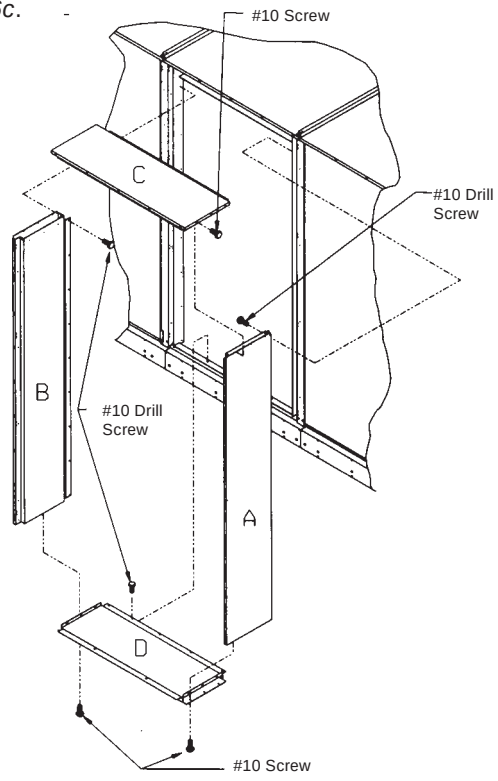
Figure 16b.



Step 3

1. Assemble side panels A and B to uprights using #10 drill screws supplied. Make certain side panels are flush against uprights before securing into place.
2. Fasten bottom panel D to base channel using #10 drill screws and to side panels A and B using #10 screws supplied.
3. Set top panel C in place and fasten to side panels A and B using #10 screws and to top panel using #10 screws supplied.

Figure 16c.

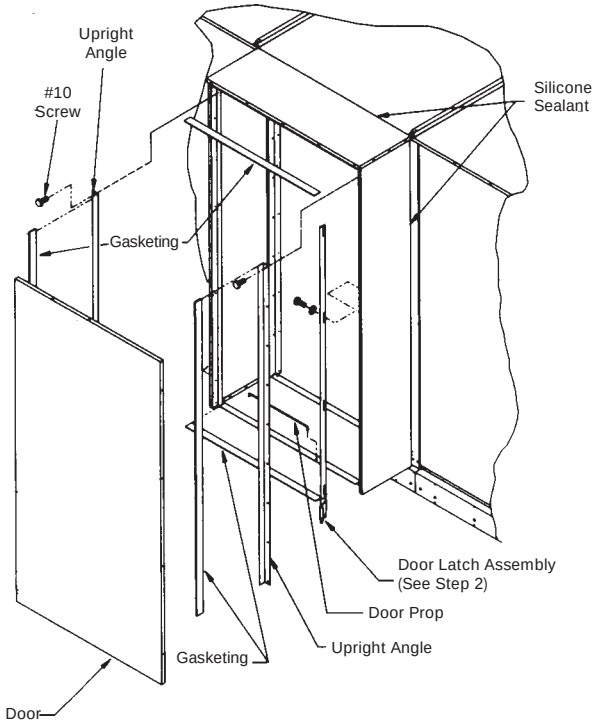


Step 4

1. Reassemble access door to vestibule by screwing hinges into side panel using screws saved from Step 1. (Access door must be attached to the vestibule in the same opening direction as it was on the unit.)
2. Remove and discard latch handle locking screws and retaining washer. Fasten door latch assembly to side panel using screws and bushing saved from Step 1. (Latch must be fastened on the same side as when located on the unit.)
3. Fasten upright angles to vestibule using #10 screws supplied.
4. Seal between unit and vestibule with silicone sealant along top and sides as shown.

Note: Any holes cut in the floor of the unit must be sealed to prevent water leakage.

Figure 16d.



Damper Assemblies

The optional damper assemblies described in this section are provided with manually adjustable linkages, or may be shipped with factory installed actuators and linkages.

Economizer dampers

Outside air intake is provided on both sides of the unit, and the return air path is at the center of the damper set. As the single actuator modulates the outside air dampers open, the return air dampers close. Exhaust air exits the unit through the gravity relief dampers provided at the end of the economizer section.

The outside air return air damper assembly (economizer) comes with manually adjustable linkage. This adjustable linkage can also be used for connection of a damper operator.

The damper is set so that the crankarm moves through a 90-degree angle to bring the economizer dampers from full open to full close. Mechanical stops have been placed in the crankarm mounting bracket. Do not remove stops. If the crankarm is driven past the stops, damage to the linkage or damper will result. The unit will ship with a shipping bolt securing the linkage crankarm. Remove shipping bolt before use.

Figure 17a.

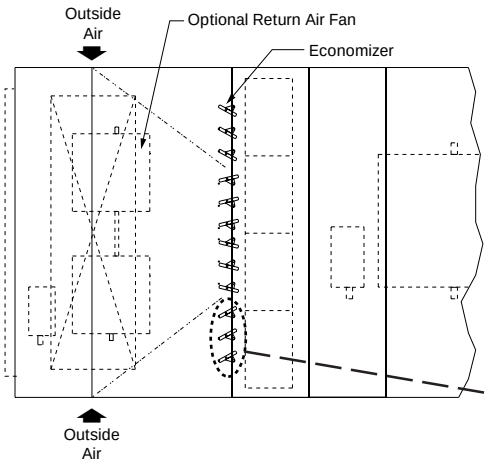


Figure 17b.

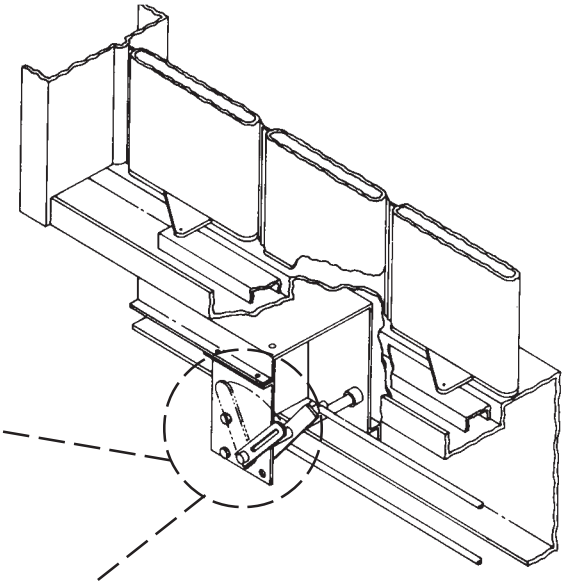
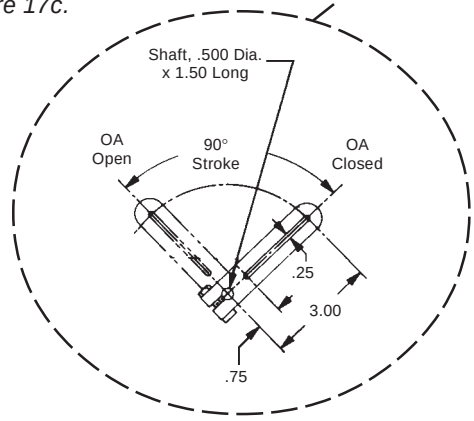


Figure 17c.



Note: For good airflow control, adjust linkages so damper blades do not open beyond 70 degrees. Opening a damper blade beyond 70 degrees has little effect on its airflow.

Do not "overclose" low leak damper blades. The edge seal should just lightly contact the adjoining blade. The blades will lock up if they are closed so far the seal goes over center.

Intake hood damper (0 to 100% outside air)

Units requiring 100% outside air are provided with a rain hood and dampers which may be controlled by a single actuator. The actuator provides two-position control for opening the dampers fully during unit operation and closing the dampers during the off cycle. No unit mounted exhaust dampers are provided.

Figure 18b.

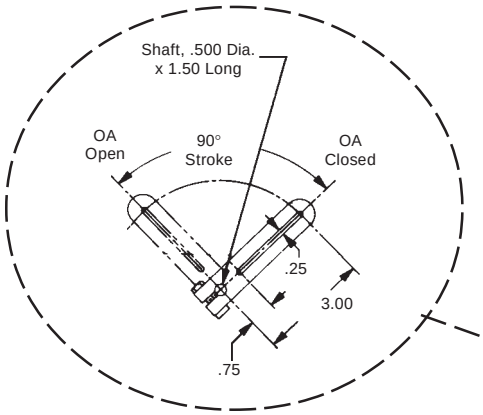
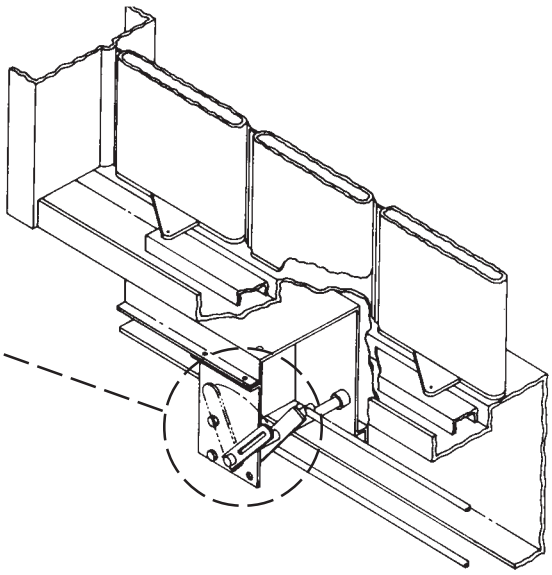


Figure 18a.



Note: For good airflow control, adjust linkages so damper blades do not open beyond 70 degrees. Opening a damper blade beyond 70 degrees has little effect on its airflow.

Do not "overclose" low leak damper blades. The edge seal should just lightly contact the adjoining blade. The blades will lock up if they are closed so far the seal goes over center.

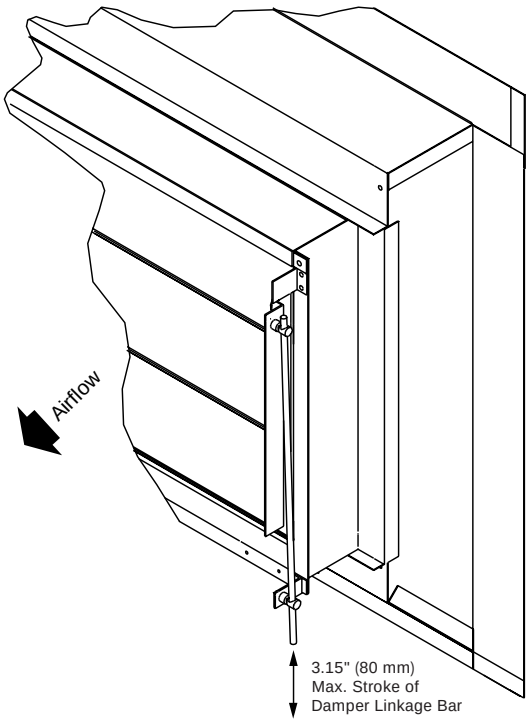
Intake hood damper (0 to 30% outside air)

These dampers are intended to remain at a fixed position during unit operation, providing fresh air quantities from 0 to 30% of the total system airflow, depending on the damper setting. This setting is made at the linkage rod on units with manually adjustable linkages.

On units provided with MicroTech controls, the damper position may be set at the controller keypad. During unit operation, the two-position actuator drives the damper to the position set on the keypad. During the off cycle, the damper is automatically closed.

No unit mounted exhaust dampers are provided with this option.

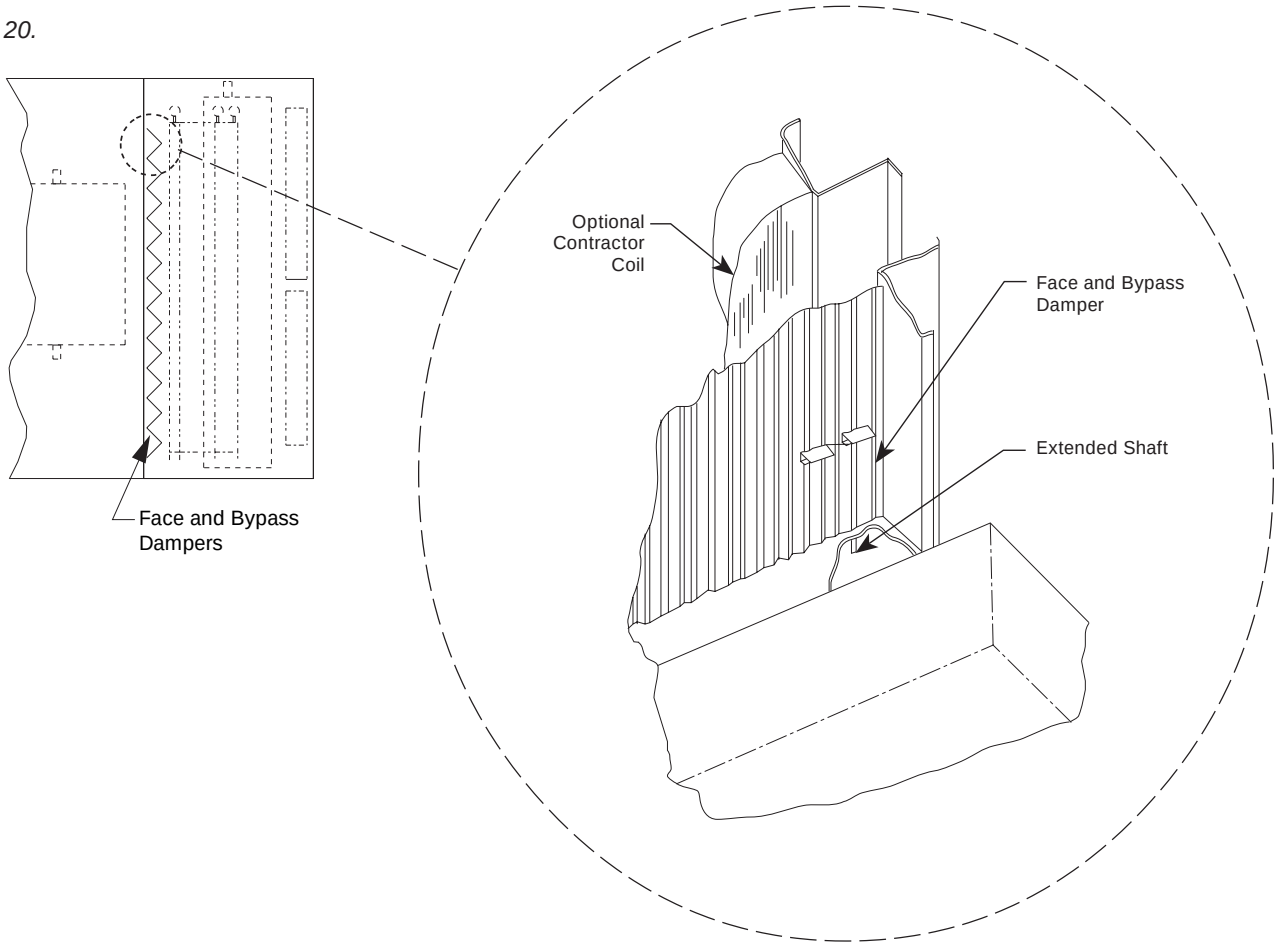
Figure 19.



Face and bypass dampers

Face and bypass dampers are available for use with contractor heating an cooling coils. The damper sets are linked through a jack shaft for connection to a factory or field installed actuator.

Figure 20.



Cabinet Weatherproofing

This unit ships from the factory with fully gasketed access doors and cabinet caulking to assure weatherproof operation. After the unit has been set in place, all door gaskets should be inspected for shipping damage and replaced if necessary.

It is recommended the unit be protected from overhead runoff from overhangs or other such structures.

Field assembled options such as external piping or vestibules are to be recaulked per the installation instructions provided with the option.

Electrical Installation

Field Power Wiring

Wiring must comply with all applicable codes and ordinances. The warranty is voided if wiring is not in accordance with these specifications. An open fuse indicates a short, ground, or overload. Before replacing a fuse or restarting a fan motor, the trouble must be found and corrected.

According to the National Electrical Code, a disconnecting means shall be located within sight of and readily accessible from the air conditioning equipment. The unit may be ordered with an optional factory mounted disconnect switch. This switch is not fused. Power leads must be over-current protected at the point of distribution. The maximum allowable overcurrent protection is shown on the unit nameplate.

Without optional electrical power package

All of the unit side panels are hinged. Disconnect switches and/or motor starters must not be mounted on panels which provide access to internal components. Wiring conduits can penetrate the cabinet bottom, base frame or through the hinge and latch cap without interfering with the access panels.

Note: All holes cut into the unit must be sealed to prevent water leakage.

⚠WARNING

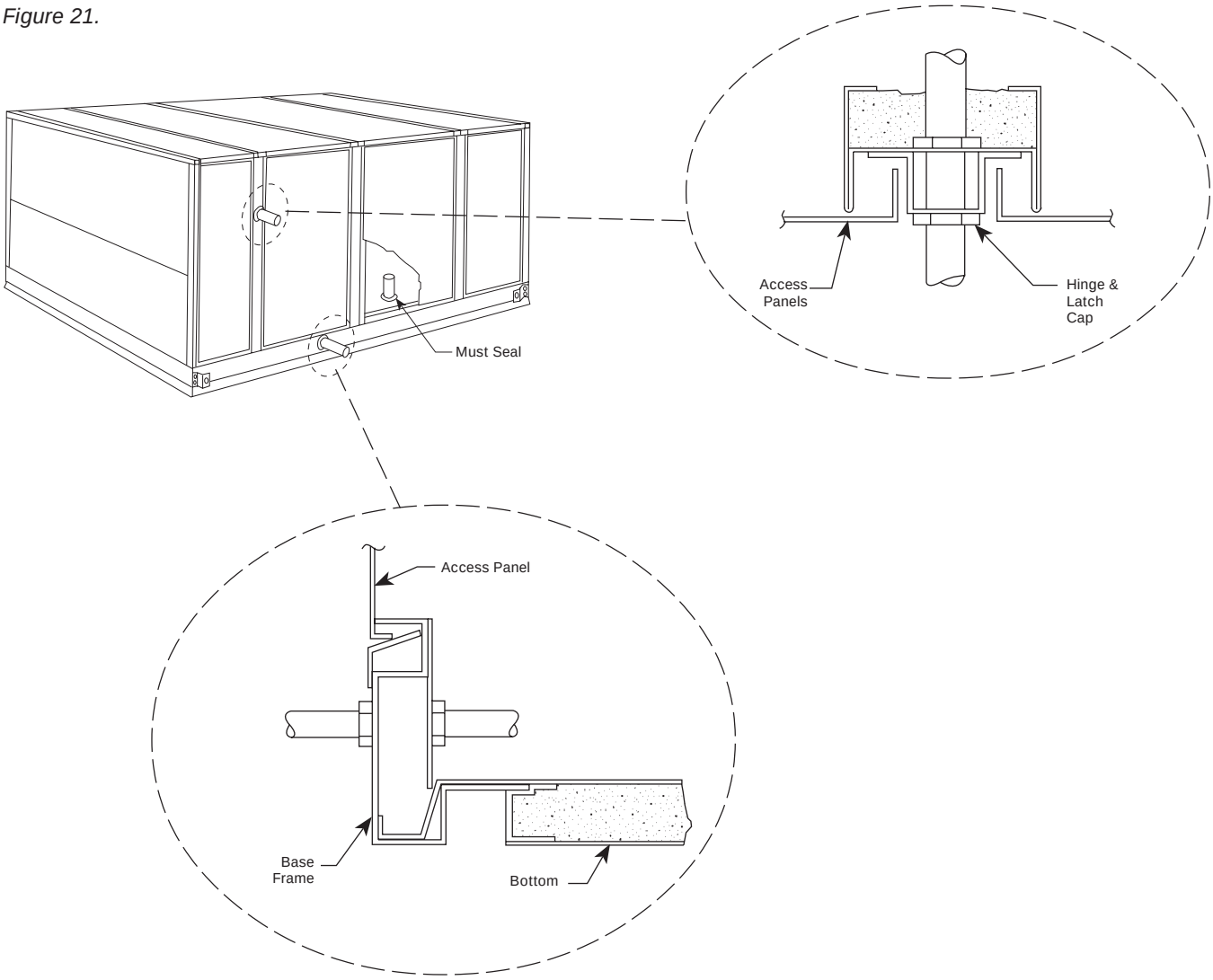
Hazardous voltage. May cause severe injury or death.

Disconnect electric power before servicing equipment. More than one disconnect may be required to de-energize the unit.

If the unit has a factory mounted disconnect switch, the switch must generally be turned off to open the main control panel door. However, the door can be opened without disconnecting power by turning the screw at the bottom of disconnect switch clockwise while pulling the door open. If this is done, however, caution must be used since power is not removed from the unit or the controller.

Conduits connecting the unit to external panels will be subjected to relative humidity and air pressure differentials and therefore should be sealed. Motor should be grounded using copper or other corrosion resistant conductor.

Figure 21.



With optional electrical power package

RDS units are provided with internal power wiring for single point power connection. The single power block or an optional disconnect switch is located within the main control panel. Field power leads are brought into the unit through 3" knockouts in the bottom of the main control panel. Refer to Figure 22a.

Note: Refer to certified drawings for dimensions to wire entry points.

The preferred entrance for power cables is through the bottom knockouts provided on the unit. If side entrance is the only option, a drilling location is provided. The drilling dimensions must be followed exactly to prevent damage to the control panel. The dimensions provided are the only possible point of side entrance for the power cables.

The minimum circuit ampacity (wire sizing amps) is shown on the unit nameplate. Refer to Table 10 for the recommended number of power wires.

Copper wire is required for all conductors. Size wires in accordance with the ampacity tables in Article 310 of the National Electrical Code. If long wires are required, it may be necessary to increase the wire size to prevent excessive voltage drop. Wires should be sized for a maximum of 3% voltage drop. Supply voltage must not vary by more than 10% of nameplate. Phase voltage imbalance must not exceed 2%. (Calculate the average voltage of the three legs. The leg with voltage deviating the farthest from the average value must not be more than 2% away.) Contact the local power company for correction of improper voltage or phase imbalance.

⚠WARNING

Improper line voltage or excessive phase imbalance constitutes product abuse. May cause severe damage to the unit's electrical components.

Assure proper line voltage and phase balance.

A ground lug is provided in the control panel for each power conduit. Size grounding conductor in accordance with Table 250-95 of the National Electrical Code.

In compliance with the National Electrical Code, an electrically isolated 115V circuit is provided in the unit to supply the factory mounted service receptacle outlet and optional unit lights. This circuit is powered by a field connected 15A, 115V power supply. Leads are brought into the RDS unit through a ⅞" knockout in the bottom of the main control panel, near the power wire entry point.

Note: The National Electrical Code requires that this 115V circuit be protected by a ground fault circuit interrupter (GFI) device (field supplied).

⚠WARNING

Electrical shock hazard. May cause severe injury or death.

All protective deadfront panels must be reinstalled and secured when power wiring is complete.

Figure 22a. RDS power wiring connection

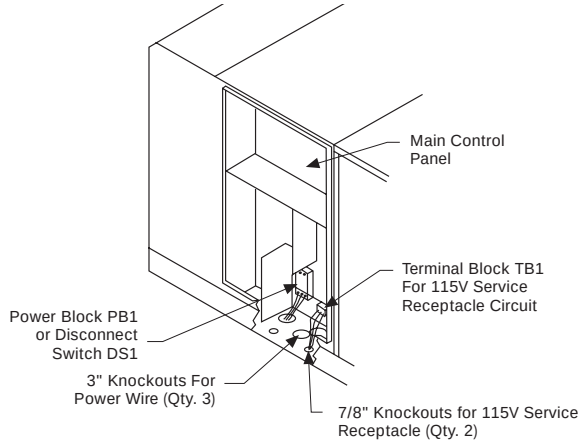

Main Control Panel
Terminal Block TB1 For 115V Service Receptacle Circuit
Power Block PB1 or Disconnect Switch DS1
3" Knockouts For Power Wire (Qty. 3)
7/8" Knockouts for 115V Service Receptacle (Qty. 2)

Figure 22b. Optional side power wiring entrance

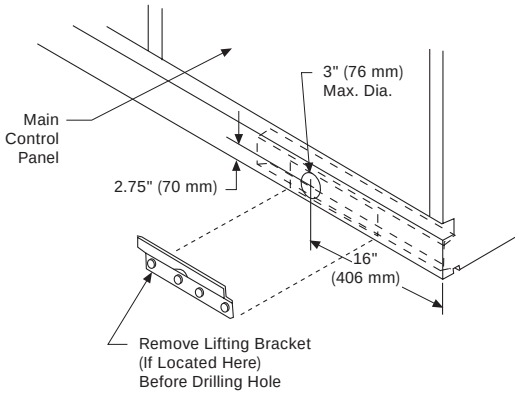


*Table 10. Recommended 3-phase power wiring**

WIRE GAUGE	QTY./ POLE	INSUL-ATION RATING (°C)	NO. OF CONDUITS	CONDUIT (TRADE SIZE, IN.)	FOR MCA UP TO (AMPS)	WIRE GAUGE	QTY. POLE	INSUL-ATION RATING (°C)	NO. OF CONDUITS	CONDUIT (TRADE SIZE, IN.)	FOR MCA UP TO (AMPS)
10	1	60	1	½	30	350	1	75	1	3	310
8	1	60	1	¾	40	400	1	75	1	3	335
6	1	60	1	1	55	500	1	75	1	3	380
4	1	60	1	1¼	70	3/0	2	75	2	2	400
3	1	60	1	1¼	85	4/0	2	75	2	2	460
2	1	60	1	1¼	95	250	2	75	2	2½	510
1	1	75	1	1¼	130	300	2	75	2	2½	570
1/0	1	75	1	1½	150	350	2	75	2	3	620
2/0	1	75	1	2	175	400	2	75	2	3	670
3/0	1	75	1	2	200	500	2	75	2	3	760
4/0	1	75	1	2	230	250	3	75	3	2½	765
250	1	75	1	2½	255	300	3	75	3	2½	855
300	1	75	1	2½	285	350	3	75	3	3	930

Notes: 1. All wire sizes assume separate conduit for each set of parallel conductors.
2. All wire sizes based on NEC Table 310-16 for THW wire (copper). Canadian electrical code wire ampacities may vary.
3. All wire sizes assume no voltage drop for short power leads.

*To assure that disconnects and power blocks mate with power wiring.

Field Control Wiring

RoofPak applied rooftop units are available with several control arrangements which may require low voltage field wiring. Detailed descriptions of various field control wiring options and requirements are included in the "Field Wiring" section of Bulletin No. IM 483, "MicroTech Applied Rooftop Unit Controller." Refer to the unit wiring diagrams for additional installation information.

Wiring must comply with applicable codes and ordinances. The warranty is voided if wiring is not in accordance with these specifications.

⚠WARNING

Electric shock hazard. Can cause severe injury or death.

Connect only low voltage NEC Class II circuits to terminal blocks TB2 and TB7.

Reinstall and secure all protective deadfront panels when the wiring installation is complete.

Most field control wiring connections are made at terminal block TB2, which is located in the main control panel. Some control options require field wiring connections to terminal block TB7, which is also located in the main control panel. Refer to Figure 23 and see "Main Control Panel" in the "Control Panel Locations" section of this manual. Two ⅞" knockouts are provided for wire entry.

Interconnecting wiring enters the RDS unit through ⅞" knockouts in the bottom of the main control panel. The 115V wiring is connected to TB5 and 24V wiring is connected to terminal block TB7. Refer to Figure 24.

A ⅞" knockout is also available in the end of the unit base as shown in Figure 24.

Note: If a single conduit containing 24V and 115V wiring is run above the roofline, the 24V wiring must be reinstalled as an NEC Class I wiring system.

Figure 23. Field control wiring connections

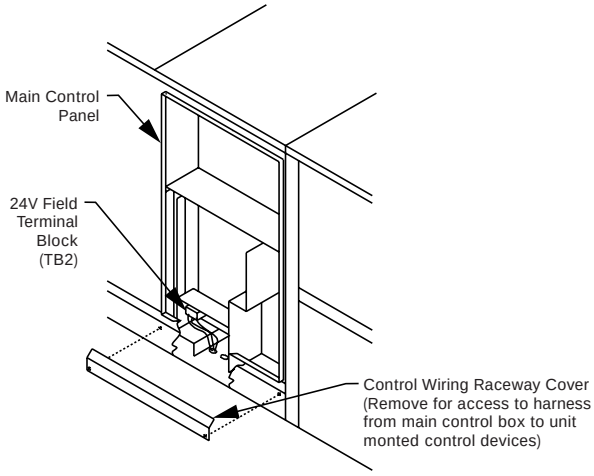
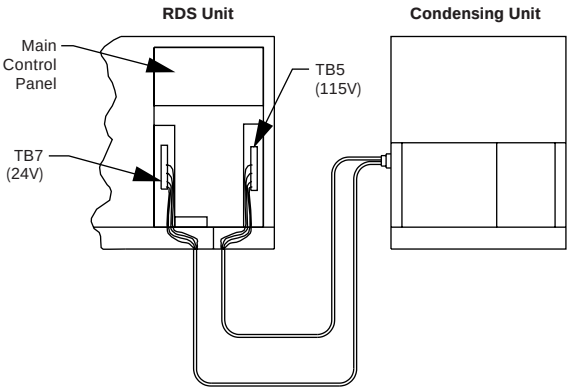

Main Control Panel
24V Field Terminal Block (TB2)
Control Wiring Raceway Cover (Remove for access to harness from main control box to unit monted control devices)

Figure 24. Interconnecting control wiring



Preparing Unit for Operation

⚠WARNING

Moving machinery hazard. May cause severe injury or death.

Disconnect power and lock off before servicing equipment. More than one disconnect may be required to de-energize unit.

Relief Damper Tie-Down

Economizer sections with a 30" or 40" return fan have a relief damper that is tied down for shipping. Two brackets and two screws must be removed before operation to allow free movement of dampers. Access is from inside the economizer section.

Spring Isolated Fans

Release of spring mounts

Spring mounted return fans or supply fans have been locked down for shipment. Using a 9/16" hexagon socket, remove the shipping lock-down bolts from the unit. (The front mounts on return fans are accessible by removing a 3" O.D. closure plug in the louvered fresh air intake area. Replace the closure plug after removing lock-down bolt.) All four bolts on each fan assembly must be removed.

Adjustment of spring mounts

Each spring mount is also provided with a leveling bolt. Turning the leveling bolts clockwise with a 15/16" socket raises the fan base; turning the bolts counterclockwise lowers the fan base. (See Figure 25 for adjustment.)

⚠WARNING

Moving machinery hazard. May cause severe injury or death.

The fans must be started for the first time in accordance with the "Check, Test and Start Procedures" section of this manual. If this is not done, severe fan damage can occur.

When the fan is running, there should be a nominal .038" clearance below for all four spring mounts as shown in Figure 25. Thus, the fan base should ride level when operating against a static pressure.

When the fan is not running, the fan assembly will tip forward and no longer be level. The "Nominal Isolator Clearance" table is provided so that leveling bolt adjustment may be done when the fan is not running. However, some further adjustment may be required to compensate for variations. Keep in mind that when the fan is running with doors shut, the assembly should ride level and the discharge housing should seal in the fan bulkhead.

Note: If it is necessary to change or replace the forward (front) isolators on the return fan, proceed as follows:

1. Open fresh air intake louver door and remove the triangular shaped floor pan (pan is fastened by sheet metal screws).
2. Forward spring mount is now visible and can be replaced if required.
3. Caulk all edges of the floor pan before reinstalling to prevent leaks.

Figure 25. Fan mounting springs

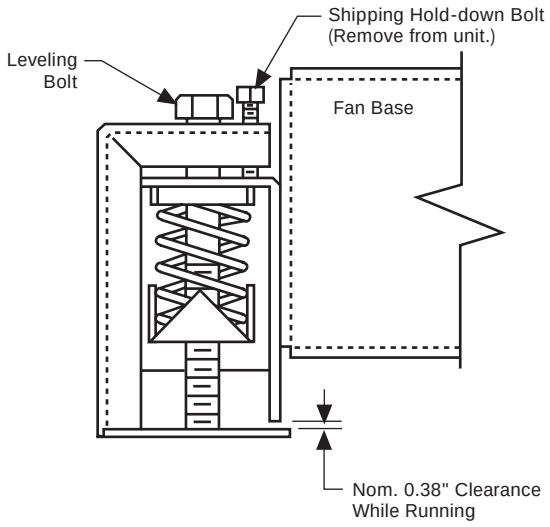


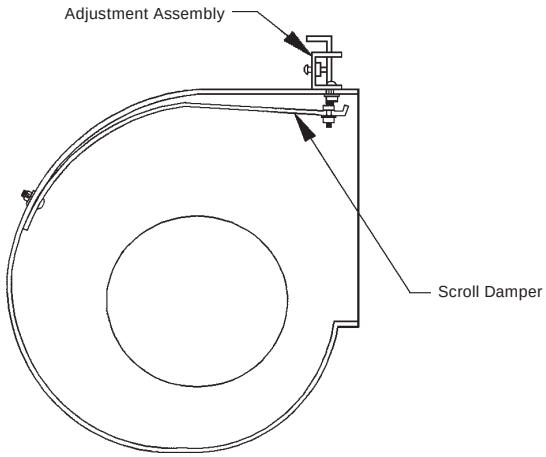
Table 11. Nominal isolator clearance, fan off

UNIT SIZE	SUPPLY FAN		RETURN FAN	
	FRONT	BACK	FRONT	BACK
800C	.06"	.75"	.25"	.50"
802C	.18"	.58"	.25"	.50"

Adjustment of Scroll Dampers

Two sets of scroll dampers are provided in the housing of the twin 15" x 6" supply fan to allow control of air volume to each fan wheel. At the factory, these dampers are fully closed unrestricting airflow. If fan paralleling occurs, correction can be made by loosening the adjustment screw on top of the fan housing (see Figure 26) and slightly lowering the rod until air distribution between the fans is even.

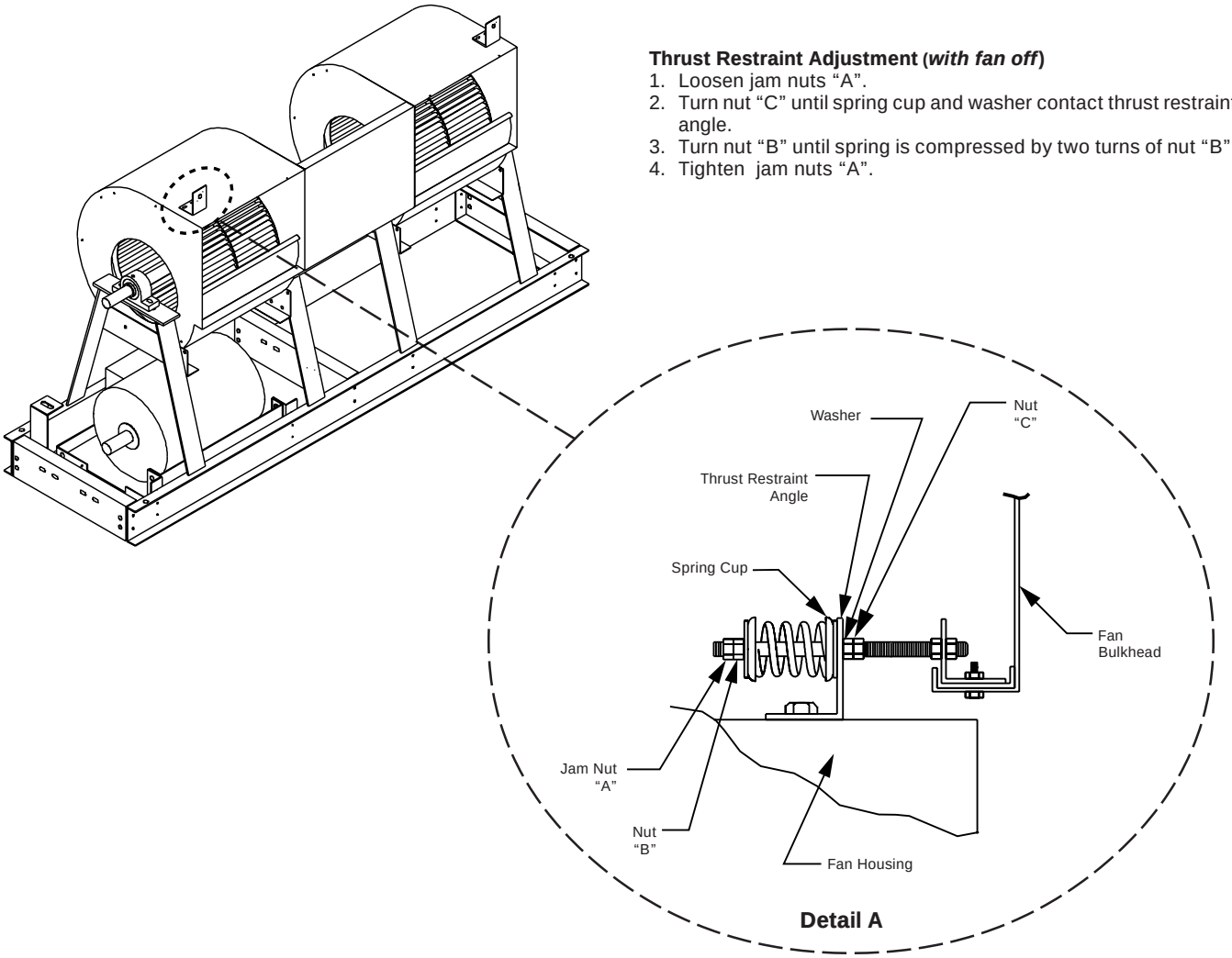
Figure 26. Scroll damper adjustment



Adjustment of Supply Fan Thrust Restraints

Thrust restraints are provided with all twin 15" supply fans. After the spring mounts have been adjusted for level operation, the thrust restraints should be checked. With the fan off, the adjustment nuts should be set so the spring is slightly compressed against the angle bolted to the fan housing frame. Refer to Figure 27. When the fan is turned on, the fan will move back to a level position and the thrust restraint springs will compress.

Figure 27. Thrust restraint adjustment



Thrust Restraint Adjustment (*with fan off*)

1. Loosen jam nuts "A".
2. Turn nut "C" until spring cup and washer contact thrust restraint angle.
3. Turn nut "B" until spring is compressed by two turns of nut "B".
4. Tighten jam nuts "A".

Adjustment of Seismic Restraints

Spring mounted supply air and return air fans may be ordered with factory installed seismic restraints. The system consists of four snubbers, one located next to each spring isolator. These snubbers will allow free movement of the fan assemblies during normal operation because normal operation will not cause fan movements that exceed .25" (6 mm). However, they will restrain the fan assembly and limit movement to .25" (6 mm) in any direction if an abnormal condition were to occur.

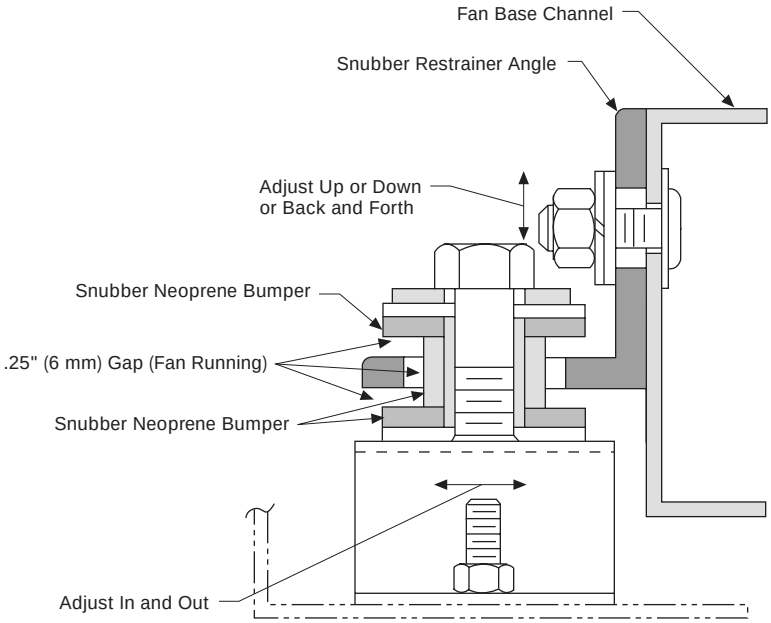
The position the fan will assume during normal operation will be determined by actual job site airflow and static pressure. Therefore, for proper operation the seismic restraints must be field adjusted as part of the normal "Check, Test and Start" procedure. When the fan is operating in a normal manner there should be no contact between the snubber restrainer angle and the snubber neoprene bumper. However, in a "seismic event," the snubber will limit movement of the spring mounted fan assembly to .25" (6 mm) in any direction, thereby preventing the fan from being tossed about and damaged, or causing damage.

When a seismic restraint is properly adjusted and the fan is operating normally, the neoprene center bumper will be centered within the 2" (51 mm) diameter hole in the restrainer angle, and the restrainer angle will be centered vertically between the flanges of the neoprene center bumper. This results in .25" (6 mm) clearance in all directions. When the fan is turned off the restrainer angle may come to rest on the neoprene center bumper.

The seismic restraint is adjustable in all directions. Vertical slots in the restrainer angle and horizontal slots in the blower base allow the restrainer angle to be adjusted up and down and back and forth. The neoprene center bumper is mounted on a slotted hole allowing its adjustment in and out.

Removing the neoprene center bumper bolt allows removal, disassembly, and replacement of the neoprene components.

Figure 28. Cross section of seismic restraint



Sequences of Operation

The following sequences of operation are for a typical "C" vintage applied rooftop unit that is equipped with an economizer, a return air fan, a MicroTech controller, an external time clock, and a Remote Monitor Panel. These sequences describe the ladder wiring diagram logic in detail; refer to the schematics in the "Wiring Diagrams" section as you read them. Note that your unit's sequences of operation may vary from those described here. Refer to the wiring diagrams supplied with the unit for exact information.

For a detailed description of operation information relating to the MicroTech controller's software, refer to the appropriate operation manual (see Table 1). These manuals describe the various set points, parameters, operating states, and control algorithms that affect rooftop unit operation.

Power-up

When primary power is connected to the unit, 115 VAC power is fed through contact circuit transformer T1 and control circuit fuse F1 (line 200) to compressor crankcase heaters HTR-1 and HTR-2 (lines 805 and 855).

When system switch S1 (line 205) is closed, low voltage transformers T2 (line 203) and T3 (line 208) are energized, and 115 VAC power is supplied to the following:

- economizer actuator ACT3 (line 336)
- supply fan vane actuator ACT1 (line 340, VAV only)
- return fan vane actuator ACT2 (line 346, VAV only)
- compressor circuit switches CS1 and CS2 (lines 807 and 857)
- unit manual pumpdown switch PS3 (line 328)

Transformer T3 supplies 18 VAC center-tapped power to the power in terminals 1, 2 and 3 on the microprocessor control board MCB1 (line 210). By way of terminal TB6-47 (lines 207 and 251), transformer T2 supplies 24 VAC power to the following:

- static pressure sensor SPS1 (line 230, VAV only)
- static pressure sensors SPS2, SPS5, SPS6 (lines 232-236)
- enthalpy sensor OAE (line 254)
- external time clock contacts (line 256)
- external exhaust fan status contacts (line 257)
- Remote Monitor Panel on-off switch (line 259)
- Remote Monitor Panel heat-auto-cool switch (lines 259 and 262)
- airflow interlock switch PC7 (line 263)
- dirty filter switches PC5 and PC6 (lines 264 and 265)
- compressor safety relays R5 and R6 (lines 266-270)
- duct high limit switch DHL (line 272, VAV and CAV-DTC only)
- gas furnace alarm relay R24 (line 275)
- freezestat switch FS1 (line 278)
- smoke detectors SD1 and SD2 (line 281)

When the fan switch on the Remote Monitor Panel is in the "off" position, field wiring terminals 105 and 106 (lines 259 and 262) are de-energized. These respective terminals are connected to the cool enable digital input D3 (terminal DH1-3) and the heat enable digital input D4 (terminal DH1-4) on the ADI board. If terminals DH1-3 and DH1-4 are both de-energized, the MicroTech controller disables fan operation because it assumes the fan switch is off. If either terminal DH1-3 or DH1-4 is energized, the MicroTech controller enables fan operation because it assumes the fan switch is on.

Fan Operation

When the supply and return fans are commanded to start by the microprocessor control board MCB1, the unit enters the Start-up Initial operating state. As a result, a 3-minute timer is set, solid-state output relay OBA15 energizes, relay R26 energizes (line 328), and the occupied output contacts close (line 395). On VAV units, output relays OBA10 and OBA12 energize (line 343), causing the supply and return fan inlet vanes to open. When the vanes open to their minimum positions, OBA10 and OBA12 are de-energized, causing the inlet vanes to hold.

After the 3-minute timer expires, the unit enters the Recirculate operating state. As a result, output relay OBA13 energizes (line 301), causing supply fan contactors M9 and M10 to energize. Four seconds after OBA13 is energized, output relay OBA14 energizes (line 303), causing return fan contactors M19 and M20 to energize. Overload relays OL9, OL10, OL19, and OL20 (line 301) protect the fans from excessive current draw. If either the supply or return fan is drawing excessive current, one of the relays will open its contacts and cause both fans to stop.

Within 30 seconds after the fans start, the controller expects airflow switch PC7 (line 263) to close and thus energize digital input D8 (terminal DH1-8) on the ADI board. (If DH2-8 does not energize, the controller will assume the fans did not start. It will then shut down the unit and generate an alarm.)

During the Recirculate operating state, the outside air damper is held closed. The controller does this by energizing output relay OBA7 (line 338). On VAV units, output relay OBA6, the VAV box output, is also energized (line 395) during the Recirculate state.

On VAV units, the supply fan vanes (ACT1) are modulated to maintain the duct static pressure set point. When energized, output relay OBA10 opens them, and OBA9 closes them (line 343). On VAV units or CAV units equipped with return fan inlet vanes, the return fan vanes (ACT2) are modulated to maintain an acceptable building static pressure. When energized, output relay OBA12 opens them, and OBA11 closes them (line 343). (Switch S6 on line 342 is provided for supply/return fan airflow balancing which is part of the unit check, test, and start procedure.)

Note: The "Typical Actuator Control Circuit" schematic shows the modulating hot water or steam heat (VM1) option that is not discussed here.

Economizer Operation

When the outdoor air is suitable for free cooling, the switch in enthalpy sensor OAE is in position "3" (line 254), and thus digital input D0 (terminal DH1-0) on the ADI board is energized. When DH-1 is energized, the economizer is enabled. If cooling is required, the economizer dampers (ACT3) are modulated to maintain the discharge air temperature set point. When energized, output relay OBA8 opens the outdoor air dampers, and OBA7 closes them (line 338). If the outdoor air dampers are wide open and more cooling is required, the dampers will hold their positions and mechanical cooling will be activated (see below).

When the outdoor air is not suitable for free cooling, the switch in enthalpy sensor OAE is in position "1", and thus digital input D0 (terminal DH1-0) on the ADI board is de-energized. When DH1-0 is de-energized, the economizer is disabled and the dampers are then held at their minimum position.

Cooling Operation

Chilled water coil, modulating valve

Refer to the "Typical Actuator Control Circuit " schematic in the following section, "Wiring Diagrams," as you read this sequence of operation.

If cooling is required, the valve motor VM5 modulates to maintain the discharge air set point. When terminal 4 and 1 are energized, output relay OBA2 opens the chilled water valve (line 332). When terminals 4 and 2 are energized, output relay OBA1 closes the chilled water valve (line 332). If both output relay OBA1 and OBA2 are closed, VM5 will stall. During periods of power failure, the chilled water valve is fully opened.

Heating Operation

Gas furnace, modulating burner

Refer to the "Typical Gas Furnace Control Circuit (Modulating Burner, Mixed Air Intake)" schematic in the following section, "Wiring Diagrams," as you read this sequence of operation. Note that the gas furnace wiring diagrams supplied with the units include a detailed sequence of operation. Refer to the wiring diagram supplied with the unit for exact wiring and sequence of operation information.

When system switch S1 is closed, 115 VAC power is supplied to the furnace control circuit. If heating is enabled [digital input D4 (terminal DH1-4) on ADI board energized] and heating is required, the MCB1 controller will energize solid-state output relay OBA3 (line 602), thus energizing relay R20. The normally open R20 contacts (line 610) close, and if manual burner switch S3 and safeties HL22, HL23, FLC (high limit switch), LP5, and HP5 are closed, terminal 16 (line 631) on the flame safeguard control (FSG) will be energized.

Relay 3K in FSG is energized via normally closed contacts 1K2 (line 628) and SSW (line 631). The flame safeguard then energizes its terminal 8 (line 623), which energizes combustion air blower motor BM (line 615). If the blower is operational, air switch AS (line 625) will close and energize FSG terminal 3. After a 90-second prepurge period, FSG relay 1K is energized and thus terminals 18 (line 630) and 5 (line 622) are energized. As a result, ignition transformer IT and pilot gas valve GV1 are energized. The pilot flame will ignite and be detected by FSG through flame rod FD (line 635). After the 10-second trial for ignition period, the FSG will energize relay 2K and light an onboard LED (lower left corner). The 2K1 contacts de-energize transformer IT via terminal 18 (line 630) and energize main gas valves GV2 and GV3 and low fire start relay R23 via terminal 6 (line 625). The R23 contacts (lines 642 and 643) allow the MicroTech controller to modulate gas valve actuator VM1 as required to satisfy the heating demand.

Whenever the burner is operating, its firing rate will be determined by the position of gas valve actuator VM1. This actuator modulates the butterfly gas valve and combustion air damper (lines 690 and 692), thus varying the furnace firing rate between 33% and 100% of full capacity. When the MicroTech controller closes output relay OBA5, VM1 modulates toward open and the firing rate increases. When the controller closes output relay OBA4, VM1 modulates toward closed and the firing rate decreases. When both OBA4 and OBA5 are open, VM1 holds its position and the firing rate remains constant.

When heating is no longer necessary, the controller opens OBA3, de-energizing relay R20 and opening its contacts in line 610. As a result, the flame safeguard control is de-energized, all gas valves close, the combustion air blower motor stops, and gas valve actuator VM1 closes. If the furnace is warm enough to close it, the FLC fan controls switch (line 606) will override supply fan start/stop output OBA13 (line 603) and keep the supply fan running until the furnace cools down (this might happen during night setback operation).

If the furnace overheats, the FLC high limit control (line 610) will cycle the burner, preventing the furnace temperature from exceeding the limit control's set point. When the furnace is cycled off, low fire start relay R23 de-energizes. The normally closed R23 contacts (line 643) cause VM1 to drive to its minimum position, overriding MicroTech control of VM1 via OBA4 and OBA5. Because relay R23 is de-energized whenever GV2 is de-energized, the burner will always start at low fire.

Safety lockout

If the pilot flame does not ignite or the flame safeguard fails to detect its flame within 10 seconds, the flame safeguard control will enter the "safety lockout" state. FSG terminals 5, 6, 8, and 18 will be de-energized, and thus the burner will be shut down. The normally open SSW contacts (line 632) will close and energize relay R24 (line 633). The R24 contacts (line 275) will energize the Remote Monitor Panel "Heat Fail" light and signal the controller that the problem exists by digital input D9 (terminal DH2-8) on the ADI board. If a safety lockout occurs, the flame safeguard control must be manually reset.

Multistage electric heat (CAV-ZTC units only)

Refer to the "Typical Electric Heat Control Circuit (Multistage)" schematic in the following section, "Wiring Diagrams," as you read this sequence of operation.

When system switch S1 is closed, 115 VAC power is supplied to the electric heat control circuit through terminals 17 and NB2 (line 559). Heating switch HS1 (line 560) is closed for normal electric heating operation.

If heating is enabled [digital input D4 (terminal DH1-4) on ADI board energized] and heating is required, the MCB1 controller will energize solid-state output relay OBA3 (line 560), allowing power to flow through the heater of sequencing relay SR1. After approximately 10 to 30 seconds, contacts in SR1 close. If the high limit temperature switches are also closed, contactors M31 and M41 will be energized (lines 560 and 562), thus supplying power to heaters 1A, 1B, 2A, and 2B (lines 511-516). These heater power circuits are protected by fuseblocks FB31 and FB41 and the high limit temperature switches. This is stage 1.

When more heat is required, the MicroTech controller energizes OBA4 for stage 2 and OBA5 for stage 3. When less heat is required, the controller de-energizes the output relays in reverse order.

Heating coil, modulating valve

Refer to the "Typical Actuator Control Circuit" schematic in the following section, "Wiring Diagrams," as you read this sequence of operation.

If heating is required, the valve motor VM1 modulates to maintain the discharge air set point. When OBA5 is energized, terminals 1 and 4 on the valve motor actuator are made, which drives the heating valve open (line 363). When OBA4 is energized, terminals 2 and 4 on the valve motor actuator are made, which drives the heating valve closed (line 363). During periods of power failure, the heating valve is fully opened.

Wiring Diagrams

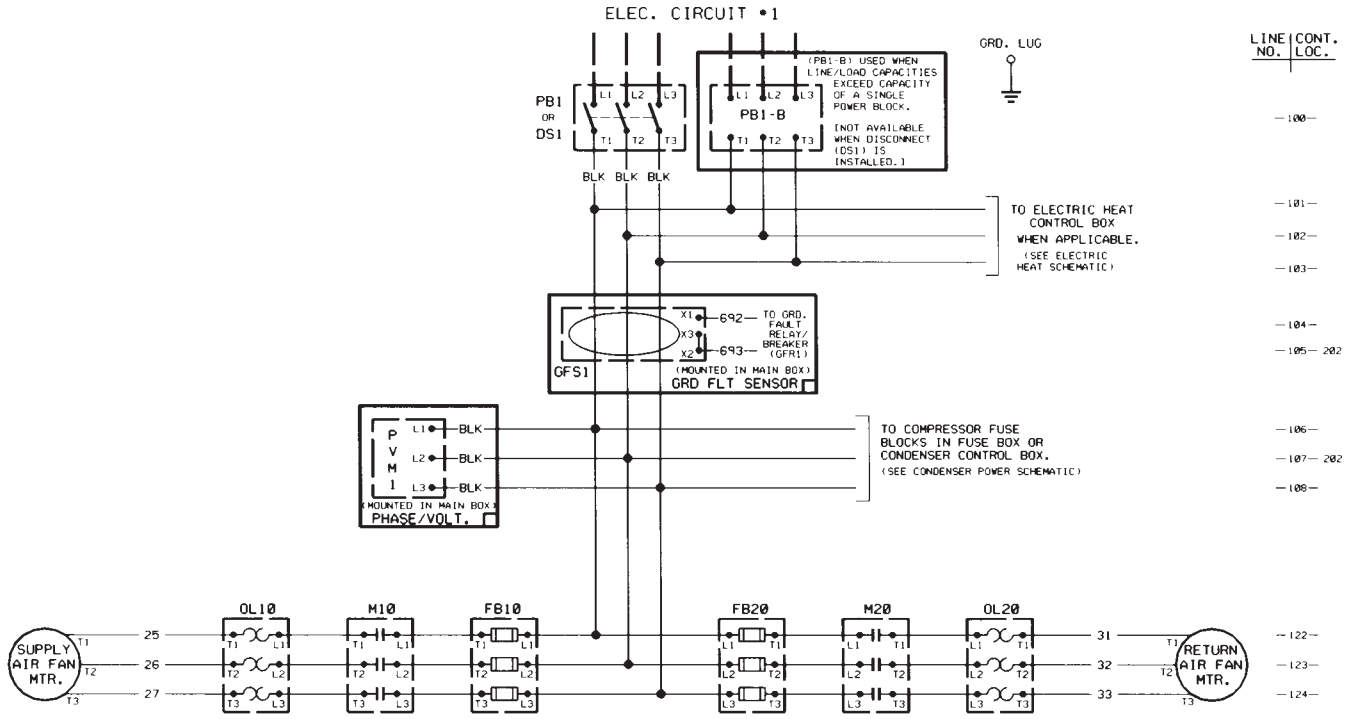
Legend

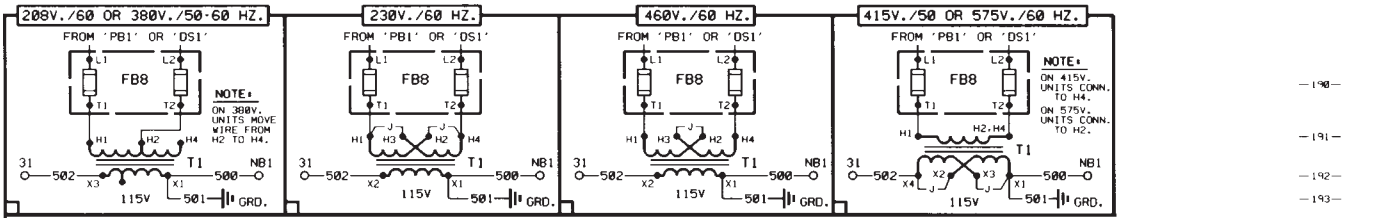
Designation	Description	Std. Location
ACT1	Actuator Motor, Supply Fan Vanes	Supply Air Sect.
ACT2	Actuator Motor, Return Fan Vanes	Return Air Sect.
ACT3, 4	Actuator Motors, Economizer Dampers	Economizer Sect.
ACT5	Actuator Motor, Discharge Isolation Damper	Discharge Sect.
ACT6	Actuator Motor, Return Air Isolation Damper	Return Air Sect.
ACT7, 8	Actuator Motors, Face & Bypass Dampers	Coil Sect.
ACT 10, 11	Actuator Motors, Exhaust Dampers	Return Air Sect.
ADI	ADI Board	Main Control Box
AFD10	Adj. Freq. Drive, SupplyFan	AFD Access Sect.
AFD20	Adj. Freq. Drive, Return Fan	AFD Access Sect.
AS	Blower Air Switch	Furnace Sect.
BM	Burner Blower Motor	Furnace Sect.
C9, 10	Power Factor Capacitors, Supply Fan	Supply Air Sect.
C19, 20	Power Factor Capacitors, Return Fan	Return Air Fan
DHL	Duct High Limit	Main Control Box
DS1	Disconnect, Total Unit or Heat	Main Control Box
DS2	Disconnect, SAF/RAF/Controls	Main Control Box
DS3	Disconnect, Electric Heat	Electric Heat Sect.
F1	Fuse, Control Circuit	Main Control Box
F3	Fuse, Burner Motor	Main Control Box
FB8	Fuseblock, Main Transformer	Main Control Box
FB9, 10	Fuseblocks, Supply Fan	Main Control Box
FB19, 20	Fuseblocks, Return Fan	Main Control Box
FB31-40	Fuseblocks, Electric Heat (Top Bank)	Electric Heat Sect.
FB41-50	Fuseblocks, Electric Heat (Bottom Bank)	Electric Heat Sect.
FD	Flame Detector	Furnace Sect.
FLC	Fan Limit Control	Furnace Sect.
FS1	Freezestat Control	Heat Sect.
FSG	Flame Safeguard	Furnace Sect.
GFS1/GFR1	Ground Fault Sensor/Relay, RPS Unit	Main Control Box
GRD	Ground	All Control Boxes
GV1	Gas Valve, Pilot	Furnace Sect.
GV2, 3	Gas Valves, Main	Furnace Sect.
HL1-10	High Limits, Elec. Heaters, Power (Top Bank)	Electric Heat Sect.
HL11-20	High Limits, Elec. Heaters, Power (Bottom Bank)	Electric Heat Sect.
HL22	High Limit, Gas Heat (Prefilters)	Supply Air Sect.
HL23	High Limit, Gas Heat (Final Filter)	Final Filter Sect.
HL31-40	High Limits, Elec. Heaters, Control (Top Bank)	Electric Heat Sect.
HL41-50	High Limits, Elec. Heaters, Control (Bottom Bank)	Electric Heat Sect.
HP5	High Pressure Control, Gas	Furnace Sect.
HS1	Heat Switch, Electric, Shutdown	Main Control Box
IT	Ignition Transformer	Furnace Sect.
LP5	Low Pressure Control, Gas	Furnace Sect.
LT2	Light, Furnace On	Furnace Sect.
LT3	Light, Pilot Gas Valve On	Furnace Sect.
LT4	Light, Main Gas Valve On	Furnace Sect.
LT10	Light, Supply Fan	Supply Air Sect.
LT11	Light, Return Fan	Return Air Sect.
LT12	Light, Heat Section	Heat Sect.
LT13	Light, Filter Section	Filter Sect.
LT14	Light, Final Filter Section	Final Filter Sect.
LT15	Light, Discharge Section	Discharge Sect.
LT16	Light, Blow-through Coil Section	Blow-thru Coil Sect.
LT17	Light, Evaporator Coil Section	Evaporator Coil Sect.
LT18	Light, Preheat Section	Preheat Sect.
LT19	Light, Blank Section	Blank Sect.
LT20	Light, Blank Compartment	Blank Compartment
LT21	Light, Draw-through Coil Section	Draw-thru Coil Sect.
M9, 10	Contactors, Supply Fan	Main Control Box
M19, 20	Contactors, Return Fan	Main Control Box
M29	Contactor, Burner Motor	Furnace Sect.
M30	Contactor, Supply AFD Bypass	AFD Access Sect.
M31-39	Contactors, Elec. Heaters (Top Bank)	Electric Heat Sect.
M40	Contactor, Return AFD Bypass	AFD Access Sect.
M41-50	Contactors, Elec. Heaters (Bottom Bank)	Electric Heat Sect.
MAT	Mixed Air Temperature Sensor	Supply Air Sect.
MCB1	Microprocessor Control Board #1	Main Control Box
MJ	Mechanical Jumpers	Terminal Blocks
NB1, 2	Neutral Blocks	Main Control Box
OAE	Outside Air Enthalpy Control	Economizer Sect.
OAT	Outside Air Temperature Sensor	Discharge Bulkhead
OBA	Output Board A, Standard	Main Control Box
OBB	Output Board B, Cooling	Main Control Box
OBC	Output Board C, Heating	Main Control Box
OL9, 10	Overload Relays, Supply Fan	Main Control Box
OL19, 20	Overload Relays, Return Fan	Main Control Box
PB1	Powerblock, Total Unit or Heat	Main Control Box
PB2	Powerblock, SAF/RAF/Controls	Main Control Box
PB3	Powerblock, Electric Heat	Electric Heat Sect.
PB9, 10	Powerblocks, Supply Fan	Unit Split Jct. Box
PB19, 20	Powerblocks, Return Fan	Unit Split Jct. Box
PC5	Pressure Control, Clogged Filter	Filter Sect.
PC6	Pressure Control, Clogged Final Filter	Final Filter Sect.
PC7	Pressure Control, Proof of Airflow	Supply Air Filter
PC8	Pressure Control, Minimum Airflow	Evaporator Coil Sect.
PM1	Phone Modem	Main Control Box
PVM1	Phase Voltage Monitor, RPS Unit	Main Control Box
R20	Relay, Gas, Steam, Hot Water Heat	Main Control Box
R21, 22	Relays, Gas Heat, 100% OA	Furnace Sect.
R23	Relay, Gas Heat, Modulating Valve	Furnace Sect.
R24	Relay, Gas Heat Alarm	Main Control Box
R26	Relay, Occupied/Unoccupied	Main Control Box
R27	Relay, Exhaust Dampers	Main Control Box
R28	Relay, Isolation Dampers	Main Control Box
R60-69	Relays, Special	Main Control Box
RAE	Return Air Enthalpy Sensor	Return Air Sect.
RAT	Return Air Temperature Sensor	Return Air Sect.
REC1	Receptacle, Main Box	Main Control Box
REC3	Receptacle, Field Power, 115V	Discharge Bulkhead
REC10-22	Receptacles, Cabinet Section	Cabinet Sections
S1	Switch, System On/Off, RPS Unit	Main Control Box
S3	Switch, Furnace On/Off	Furnace Sect.
S4, 5	Switches, AFD Bypasses	Main Control Box
S6	Switch, Return Fan Vanes Adjustment	Main Control Box
S10-22	Switches, Cabinet Section Lights	Cabinet Sections
SAT	Supply Air Temperature Sensor	Discharge Sect.
SB1	Staging Board #1, Cooling	Main Control Box
SB2	Staging Board #2, Heating	Main Control Box
SD1	Smoke Detector, Supply Air	Discharge Sect.
SD2	Smoke Detector, Return Air	Return Air Sect.
SPS1, 2	Static Pressure Sensors, Duct or Building	Main Control Box
SPS5	Static Pressure Sensor, Clogged Filter	Filter Sect.
SPS6	Static Pressure Sensor, Clogged Final Filter	Final Filter Sect.
SR1-3	Sequence Relays, Electric Heat	Electric Heat Sect.
T1	Transformer, Main Control	Main Control Box
T2	Transformer, Unit 24V	Main Control Box
T3	Transformer, Controller, 18V	Main Control Box
T4	Transformer, Exhaust Dampers	Main Control Box
T5	Transformer, Electric Heat	Electric Heat Sect.
T7	Transformer, Gas Pilot Valve	Furnace Sect.
T8	Transformer, Gas Main Valve	Furnace Sect.
TB1	Terminal Block, 115V, Field	Main/Cond. Ctrl Box
TB2	Terminal Block, 24V, Field	Main/Cond. Ctrl Box
TB5	Terminal Block, 115V, Factory	Main Control Box
TB6	Terminal Block, 115V/24V, Factory	Main Control Box
TB7, 8	Terminal Block, 24V, Factory	Main Control Box
TB10	Terminal Block, Heating	Main Control Box
TB11	Terminal Block, Heating	Electric Heat Sect.
TB12, 13	Terminal Blocks, Electric Heat, Power	Electric Heat Sect.
TB25	Terminal Block, 115V, Factory	Unit Split, Jct. Box
TB27, 28	Terminal Blocks, 24V, Factory	Unit Split, Jct. Box
TD9	Time Delay, Supply Fan Part Winding	Main Control Box
TD19	Time Delays, Return Fan Part Winding	Main Control Box
VM1	Valve Motor #1, Heating	Heating Sect.
VM5	Valve Motor #1, Cooling	Cooling Sect.
VV1	Vent Valve, Gas Heat	Furnace Sect.
ZNT1	Zone Temperature Sensor, Control	Field Installed
ZNT2-5	Zone Temperature Sensors, Special	Field Installed

GENERAL NOTES

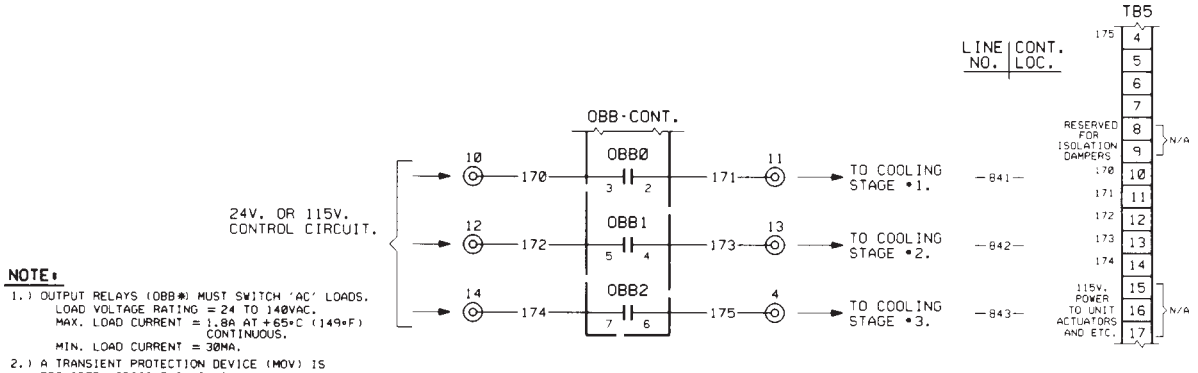
1. Field Wiring
2. Wiring in Remote Unit
3. Wiring Between Boxes
4. Shielded Wire Cable
5. Main Control Box (Terminals)
6. Cond/Heat Control Box (Terminals)
7. Field Wiring Terminal
8. Remote Panel Terminal
9. Wire Connector
10. Plug-in Connector
11. 200 Wire Number
12. Option Block

Typical Power Circuit



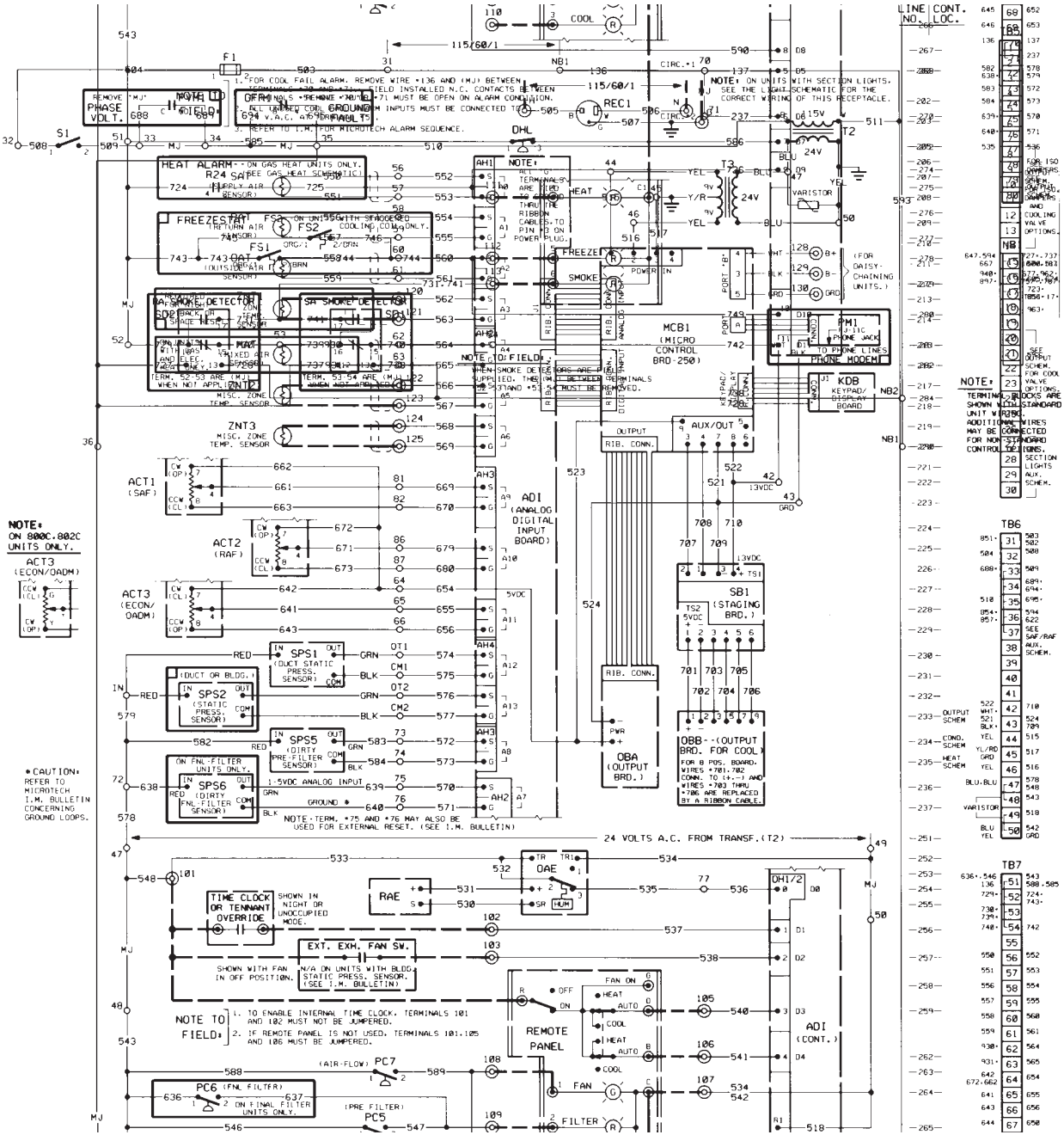


Typical Compressor Staging Outputs

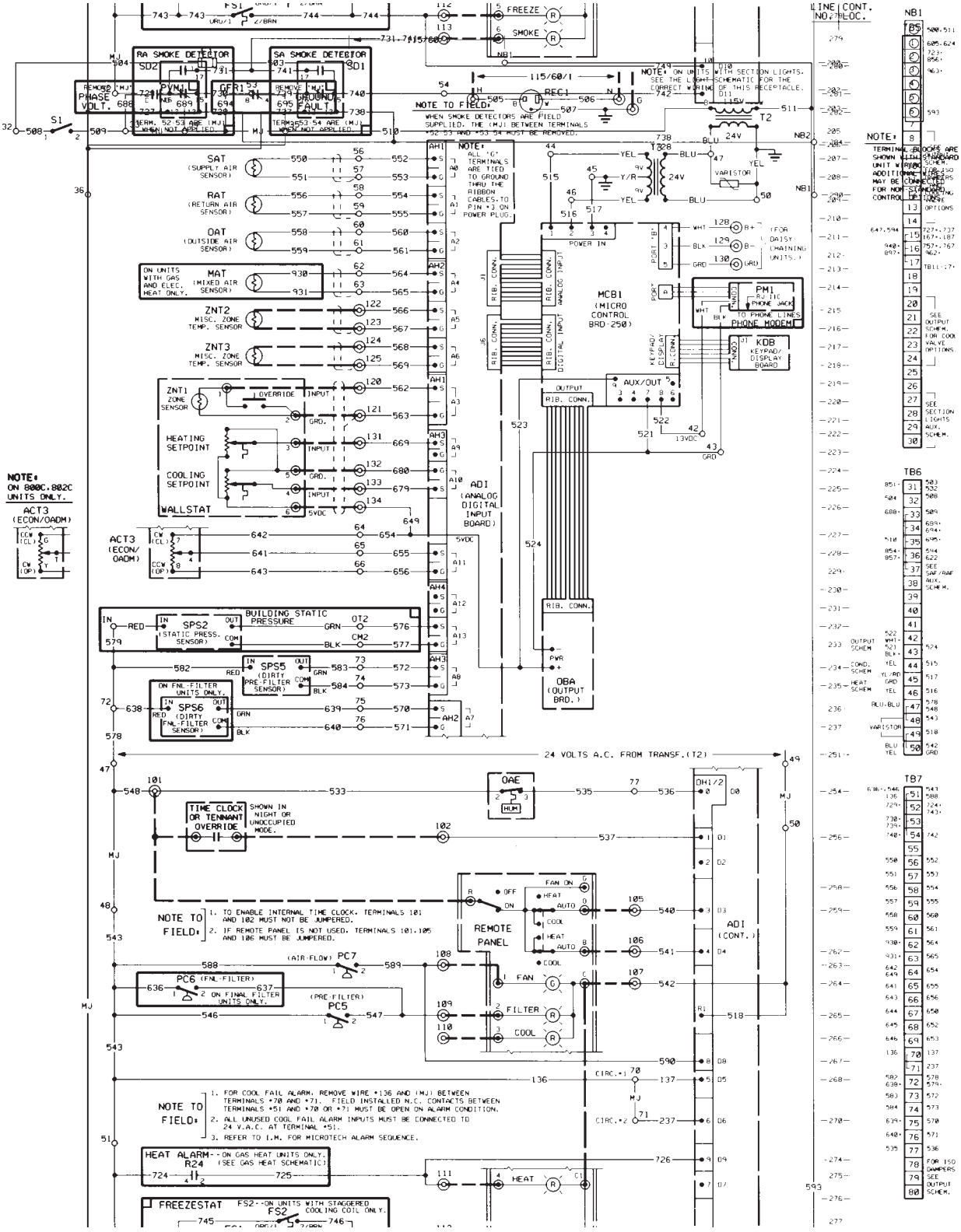


NOTE:
1.) OUTPUT RELAYS (OBB#) MUST SWITCH 'AC' LOADS.
LOAD VOLTAGE RATING = 24 TO 140VAC.
MAX. LOAD CURRENT = 1.8A AT +65°C (149°F) CONTINUOUS.
MIN. LOAD CURRENT = 30MA.
2.) A TRANSIENT PROTECTION DEVICE (MOV) IS PROVIDED ACROSS EACH SOLID STATE RELAY OUTPUT.

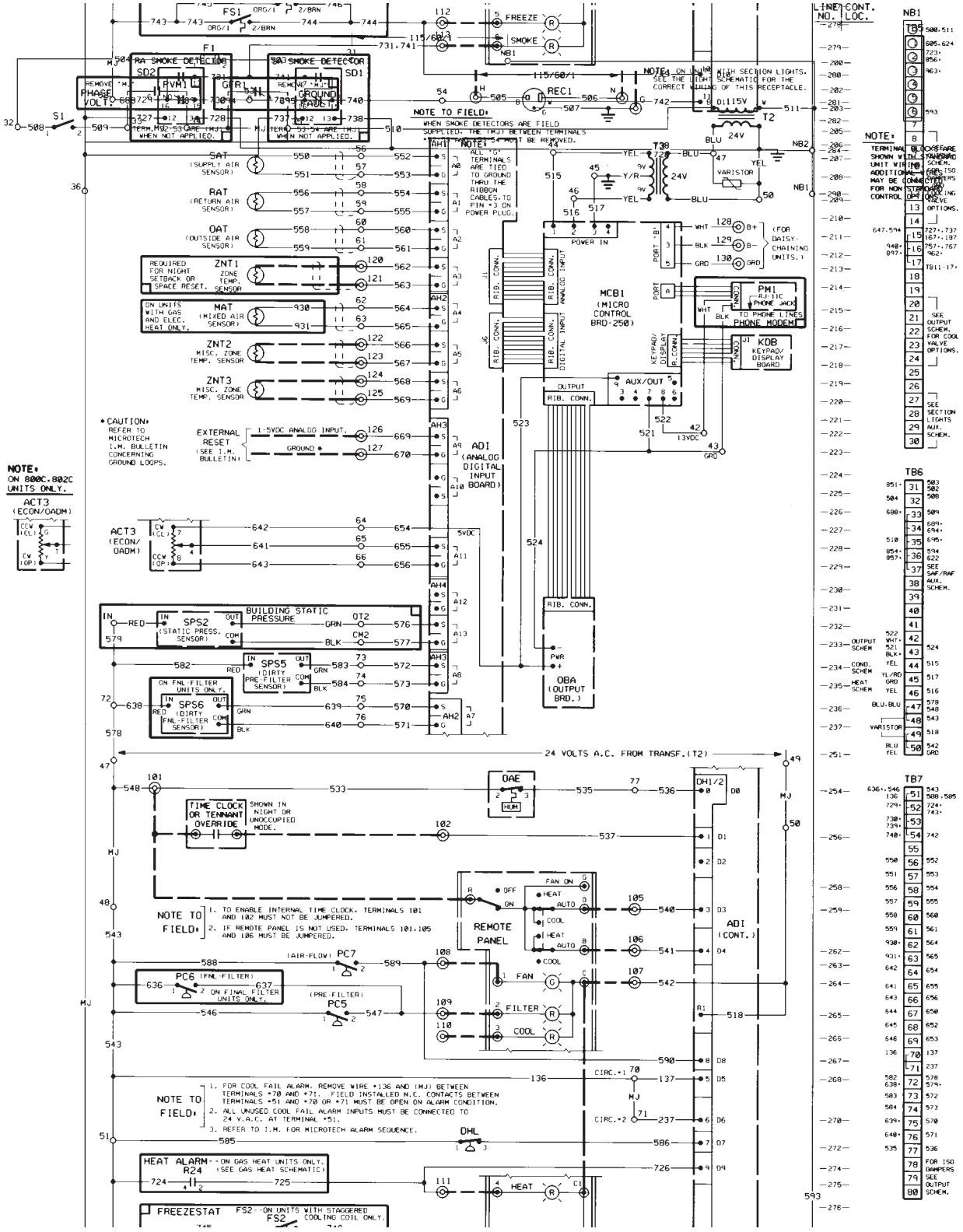
Typical Main Control Circuit (VAV Units)



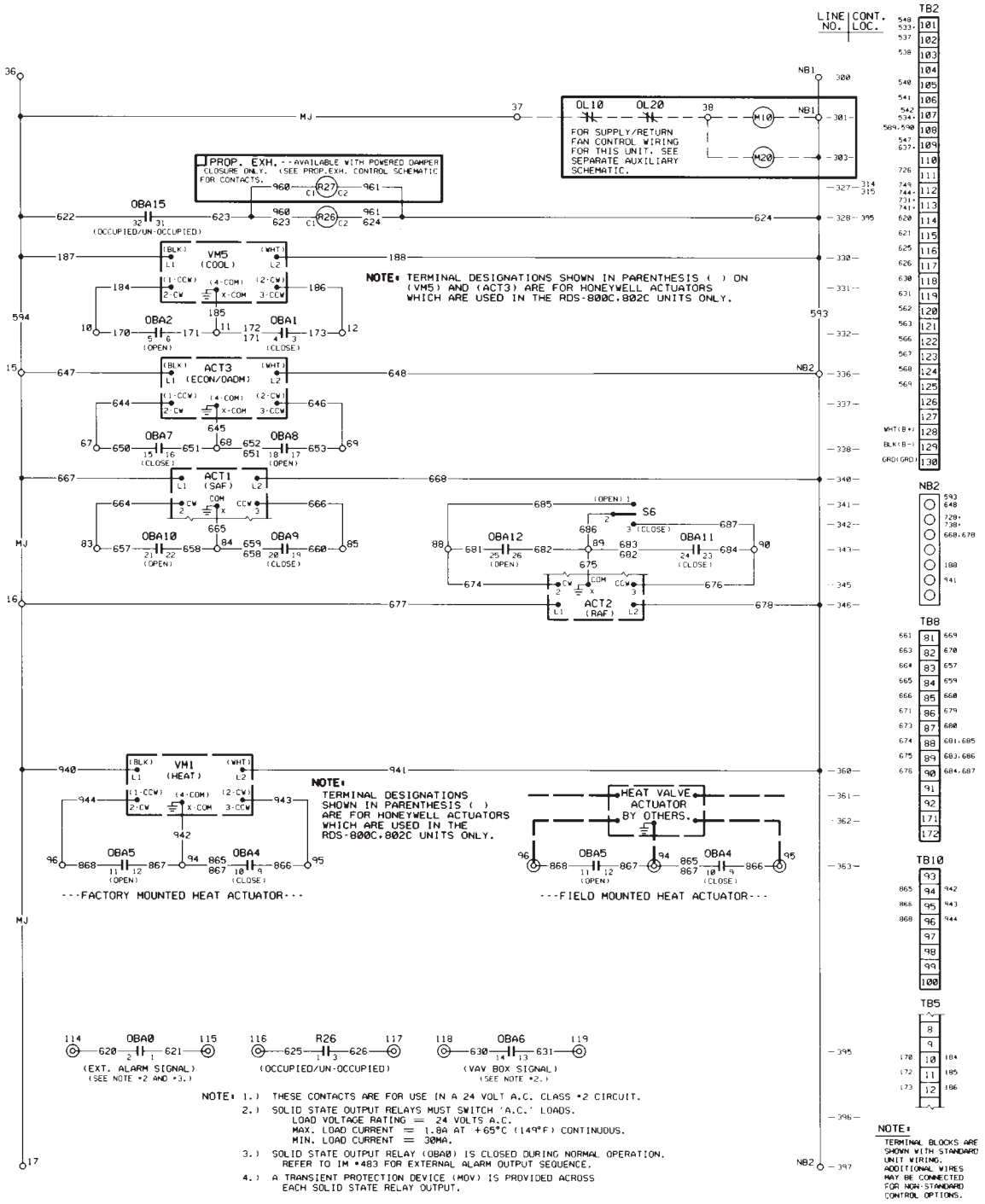
Typical Main Control Circuit (CAV-ZTC Units)


RA SMOKE DETECTOR
SD2
SA SMOKE DETECTOR
SD1
PHASE VOLT. MONITOR
PVM1
GFR1
GROUND FAULT
SAT (SUPPLY AIR SENSOR)
RAT (RETURN AIR SENSOR)
OAT (OUTSIDE AIR SENSOR)
MAT (MIXED AIR SENSOR)
ON UNITS WITH GAS AND ELEC. HEAT ONLY.
ZNT2 MISC. ZONE TEMP. SENSOR
ZNT3 MISC. ZONE TEMP. SENSOR
ZNT1 ZONE SENSOR
OVERRIDE INPUT
HEATING SETPOINT
COOLING SETPOINT
WALLSTAT
ACT3 (ECON/OADM)
SPS2 (STATIC PRESS. SENSOR)
BUILDING STATIC PRESSURE
SPS5 (DIRTY PRE-FILTER SENSOR)
SPS6 (DIRTY FNL-FILTER SENSOR)
ON FNL-FILTER UNITS ONLY.
FREEZE
SMOKE
REC1
115/60/1
T2
24V
VARISTOR
MCB1 (MICRO CONTROL BRD-250)
PM1 RJ-11C PHONE JACK
TO PHONE LINES
PHONE MODEM
KDB KEYPAD/ DISPLAY BOARD
AUX/OUT
ADI (ANALOG DIGITAL INPUT BOARD)
OBA (OUTPUT BRD.)
POWER IN
(FOR DAISY-CHAINING UNITS.)
24 VOLTS A.C. FROM TRANSF.(T2)
TIME CLOCK OR TENNANT OVERRIDE
SHOWN IN NIGHT OR UNOCCUPIED MODE.
OAE
REMOTE PANEL
FAN ON
OFF
HEAT
COOL
AUTO
FAN
FILTER
PC7 (AIR-FLOW)
PC6 (FNL-FILTER)
ON FINAL FILTER UNITS ONLY.
PC5 (PRE-FILTER)
ADI (CONT.)
NOTE TO FIELD:
1. TO ENABLE INTERNAL TIME CLOCK, TERMINALS 101 AND 102 MUST NOT BE JUMPERED.
2. IF REMOTE PANEL IS NOT USED, TERMINALS 101-105 AND 106 MUST BE JUMPERED.
1. FOR COOL FAIL ALARM, REMOVE WIRE #136 AND (MJ) BETWEEN TERMINALS #70 AND #71. FIELD INSTALLED N.C. CONTACTS BETWEEN TERMINALS #51 AND #70 OR #71 MUST BE OPEN ON ALARM CONDITION.
2. ALL UNUSED COOL FAIL ALARM INPUTS MUST BE CONNECTED TO 24 V.A.C. AT TERMINAL #51.
3. REFER TO I.M. FOR MICROTECH ALARM SEQUENCE.
HEAT ALARM--ON GAS HEAT UNITS ONLY. (SEE GAS HEAT SCHEMATIC)
R24
FREEZESTAT
FS2--ON UNITS WITH STAGGERED COOLING COIL ONLY.
NOTE: ON 800C-882C UNITS ONLY.
NOTE: ALL 'G' TERMINALS ARE TIED TO GROUND THRU THE RIBBON CABLES. TO PIN #3 ON POWER PLUG.
NOTE TO FIELD: WHEN SMOKE DETECTORS ARE FIELD SUPPLIED, THE (MJ) BETWEEN TERMINALS #52-53 AND #53-54 MUST BE REMOVED.
LINE | CONT. NO. | LOC.
NB1
NB2
TB6
TB7

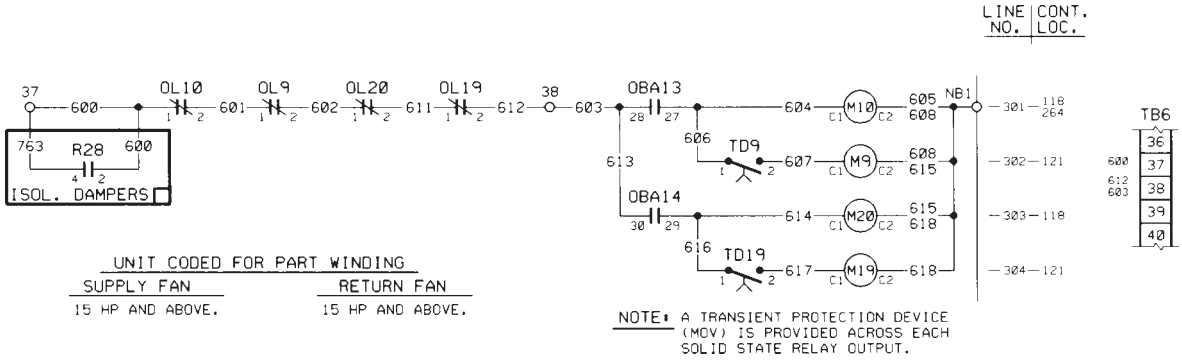
Typical Main Control Circuit (CAV-DTC Units)



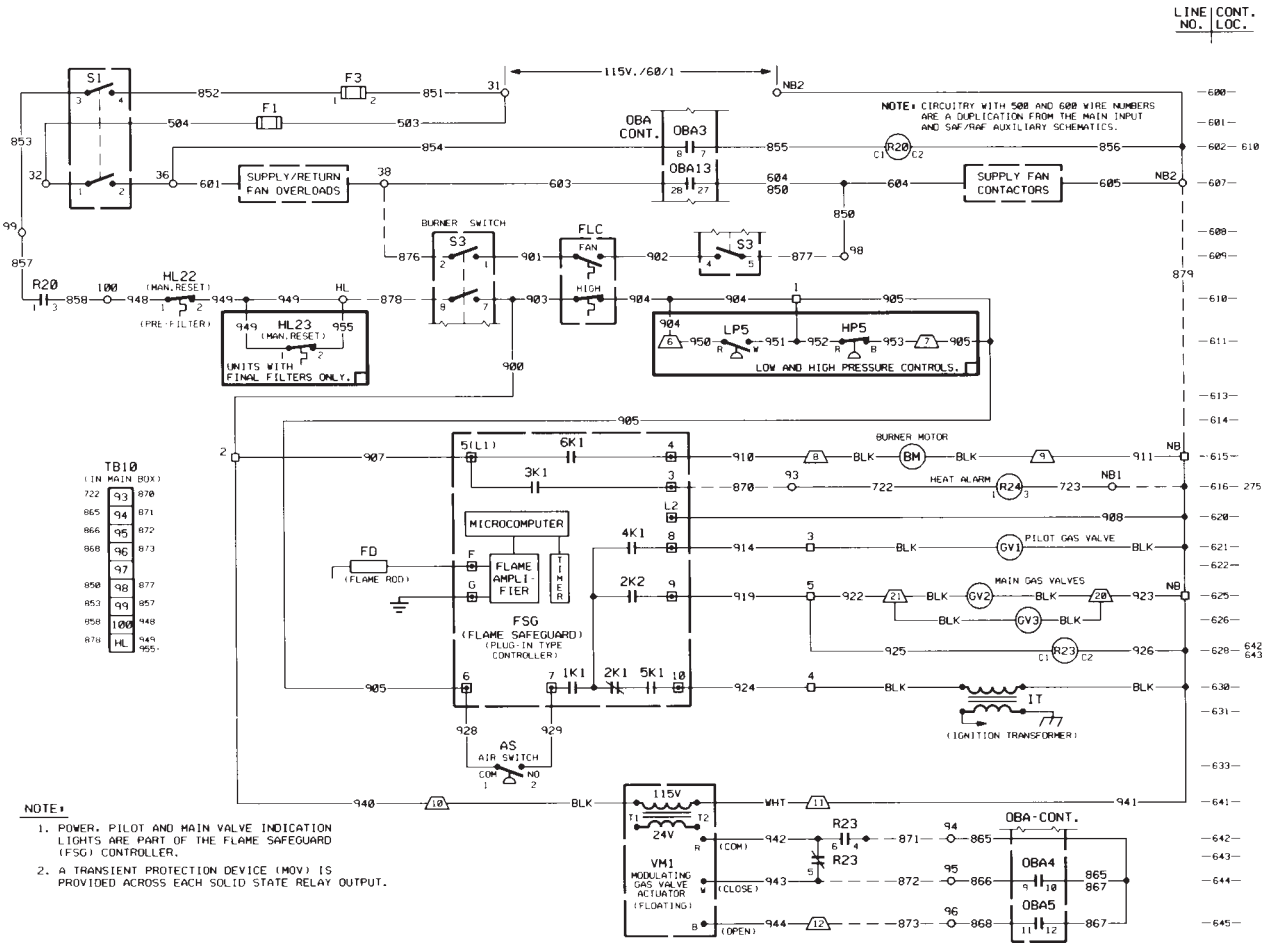
Typical Actuator Control Circuit


LINE NO. | CONT. LOC.
TB2
NB1
NB2
TB8
TB10
TB5
OL10 OL20
FOR SUPPLY/RETURN FAN CONTROL WIRING FOR THIS UNIT. SEE SEPARATE AUXILIARY SCHEMATIC.
PROP. EXH. --AVAILABLE WITH POWERED DAMPER CLOSURE ONLY. (SEE PROP.EXH. CONTROL SCHEMATIC FOR CONTACTS.
OBA15
(OCCUPIED/UN-OCCUPIED)
VM5 (COOL)
ACT3 (ECON/DADM)
ACT1 (SAF)
ACT2 (RAF)
VM1 (HEAT)
OBA2 (OPEN)
OBA1 (CLOSE)
OBA7 (CLOSE)
OBA8 (OPEN)
OBA10 (OPEN)
OBA9 (CLOSE)
OBA12 (OPEN)
OBA11 (CLOSE)
OBA5 (OPEN)
OBA4 (CLOSE)
S6
NOTE: TERMINAL DESIGNATIONS SHOWN IN PARENTHESIS ( ) ON (VM5) AND (ACT3) ARE FOR HONEYWELL ACTUATORS WHICH ARE USED IN THE RDS-800C,802C UNITS ONLY.
NOTE: TERMINAL DESIGNATIONS SHOWN IN PARENTHESIS ( ) ARE FOR HONEYWELL ACTUATORS WHICH ARE USED IN THE RDS-800C,802C UNITS ONLY.
HEAT VALVE ACTUATOR BY OTHERS.
---FACTORY MOUNTED HEAT ACTUATOR---
---FIELD MOUNTED HEAT ACTUATOR---
OBA0 (EXT. ALARM SIGNAL) (SEE NOTE *2 AND *3.)
R26 (OCCUPIED/UN-OCCUPIED)
OBA6 (VAV BOX SIGNAL) (SEE NOTE *2.)
NOTE: 1.) THESE CONTACTS ARE FOR USE IN A 24 VOLT A.C. CLASS *2 CIRCUIT.
2.) SOLID STATE OUTPUT RELAYS MUST SWITCH 'A.C.' LOADS.
LOAD VOLTAGE RATING = 24 VOLTS A.C.
MAX. LOAD CURRENT = 1.8A AT +65°C (149°F) CONTINUOUS.
MIN. LOAD CURRENT = 30MA.
3.) SOLID STATE OUTPUT RELAY (OBA0) IS CLOSED DURING NORMAL OPERATION. REFER TO IM *483 FOR EXTERNAL ALARM OUTPUT SEQUENCE.
4.) A TRANSIENT PROTECTION DEVICE (MOV) IS PROVIDED ACROSS EACH SOLID STATE RELAY OUTPUT.
NOTE: TERMINAL BLOCKS ARE SHOWN WITH STANDARD UNIT WIRING. ADDITIONAL WIRES MAY BE CONNECTED FOR NON-STANDARD CONTROL OPTIONS.

Typical Supply/Return Fan Control Circuit



Typical Gas Furnace Control Circuit
(Modulating Burner, Mixed Air Intake)



Sequence of Operation: When the rooftop unit is energized, 120 volt power is supplied through the system on-off switch S1 to OBA3 contacts. Upon a call for heat, the control system will close OBA3, thus energizing relay R20. 120 Volt power is furnished through the system on-off switch S1, through relay R20 closed contacts, through the burner on-off switch S3, through the high limit control FLC and through the optional automatic reset low pressure switch LP5 and the optional manual reset high gas pressure switch HP5, to power terminal 6 on the flame safeguard control FSG. The flame safeguard then energizes its terminal 4, which powers the burner combustion air blower motor BM. Blower operation is sensed by the air switch AS which makes terminal 6 to 7. After a 90-second prepurge period, terminal 8 (pilot gas valve GV1) and terminal 10 (ignition transformer IT) will be energized. The pilot flame will ignite and be detected by the flame safeguard through the flame rod FD. Upon detection of pilot flame, terminal 10 (ignition transformer IT) will be de-energized and terminal 9 (main gas valves GV2 and GV3) will be energized and the main flame will come on. Also, the flame safeguard contains LEDs (lower left corner) that will glow to indicate operation.

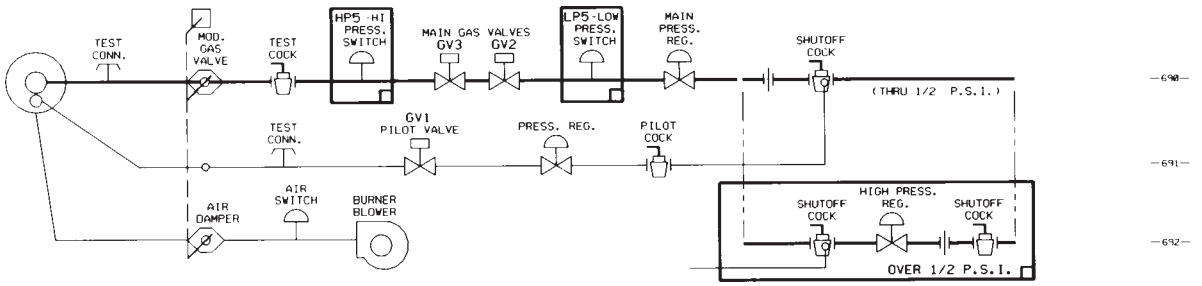
Low fire start is provided by relay R23. The relay drives the gas valve actuator VM1 to the minimum firing rate position whenever the flame is not on and holds it there until the flame has lit and been proven.

Whenever the burner is in operation its firing rate will be determined by the “floating” gas valve actuator VM1. This actuator positions the butterfly gas valve and combustion air damper and can set the firing rate between 33% and 100% of normal rate. When the main control system closes OBA5, the gas valve actuator will reposition toward a higher firing rate until either OBA5 opens or the actuator reaches its maximum position. When the main control system closes OBA4, the actuator will reposition toward a lower firing rate. If neither OBA4 or OBA5 are closed, the actuator will remain at its present position.

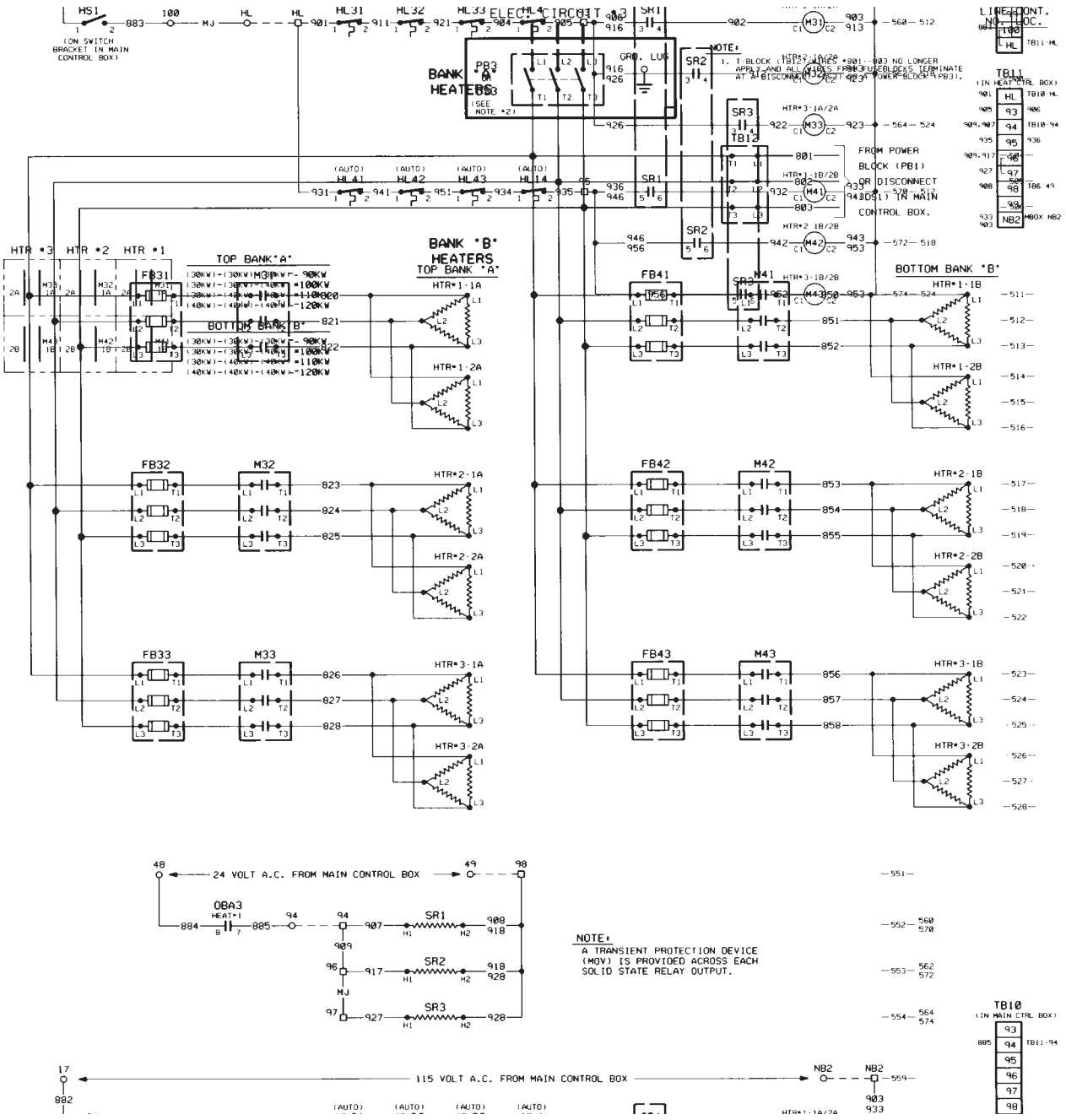
In the event the pilot fails to ignite or the flame safeguard fails to detect its flame within 10 seconds, terminal 4, 8, 9 and 10 will be de-energized, thus de-energizing the burner. The flame safeguard would then be on safety lockout and would require manual resetting. The heat alarm relay R24 would then be energized and would then energize the remote “heat fail” indicator light and send a fail signal to the MicroTech input board ADI.

If the unit overheats, the high limit control FLC will cycle the burner limiting furnace temperature to the limit control set point.

Piping Diagram



Typical Electric Heat Control Circuit (Multistage)



Unit Options

Enthalpy Control

Outside air enthalpy control (OAE)

Units with MicroTech control and an economizer come standard with an electromechanical enthalpy control device (OAE) which senses both the humidity and temperature of the outside air entering the unit. This device has an enthalpy scale marked A through D. Table 12 shows the control points at 50% RH for settings A through D. Figure 29 shows this scale on a psychrometric chart. When the outside air conditions exceed the setting of the device, the outside air dampers are positioned to the minimum outside air intake position by the MicroTech controller.

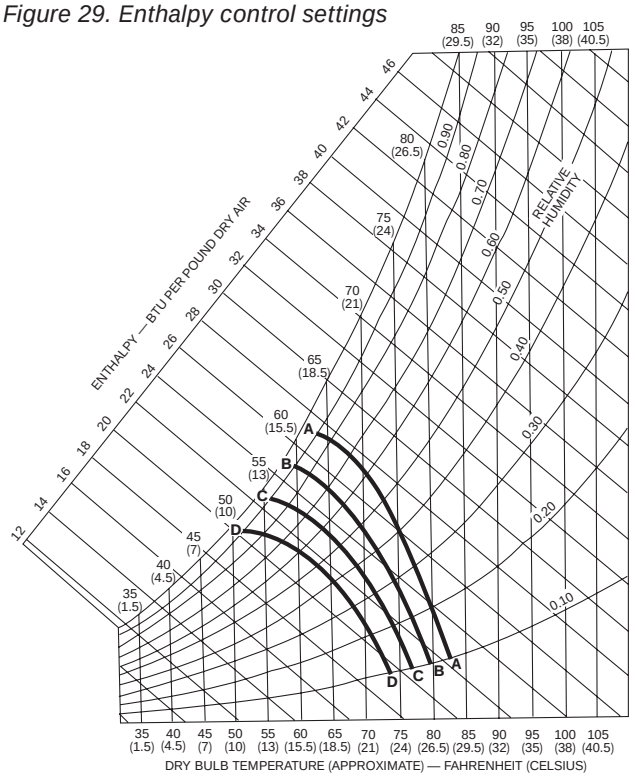
Table 12. Enthalpy control settings

CONTROL CURVE	CONTROL POINT TEMP. AT 50% RH
A	73°F (23°C)
B	70°F (21°C)
C	67°F (19°C)
D	63°F (17°C)

Differential enthalpy control (OAE/RAE)

An optional electric differential enthalpy control arrangement (OAE/RAE) is available on units with MicroTech control. In this configuration a solid-state humidity and temperature sensing device is located in both the return (RAE) and outside intake (OAE) airstreams. This OAE device has the same A through D scale as the device described above. However, with the OAE/RAE arrangement the switch on OAE must be set all the way past the "D" setting. With this done, the MicroTech controller will adjust the return and outside air dampers to use the airstream with the lowest enthalpy.

Figure 29. Enthalpy control settings



Phase Voltage Monitor

The phase voltage monitor protects against phase loss (single phasing) when any one of three line voltages drops to 74% or less of setting. This device also protects against phase reversal when improper phase sequence is applied to equipment, and low voltage (brownout) when all three line voltages drop to 90% or less of setting. An indicator run light is "on" when all phase voltages are within specified limits. The phase voltage monitor is located on the load side of the power block with a set of contacts wired to the 115 volt control circuit to shut the unit down whenever the phase voltages are outside the specified limits.

Remote Monitor Panel

The optional Remote Monitor Panel provides indicator lights and fan on-off and system heat-auto-cool switches remote from the MicroTech unit controller. Refer to Figure 30.

Wiring should be sized in accordnace with Table 13 and connected to the panel terminals in accordance with the unit wiring diagram. The panel can be mounted on a standard 4x4 junction box

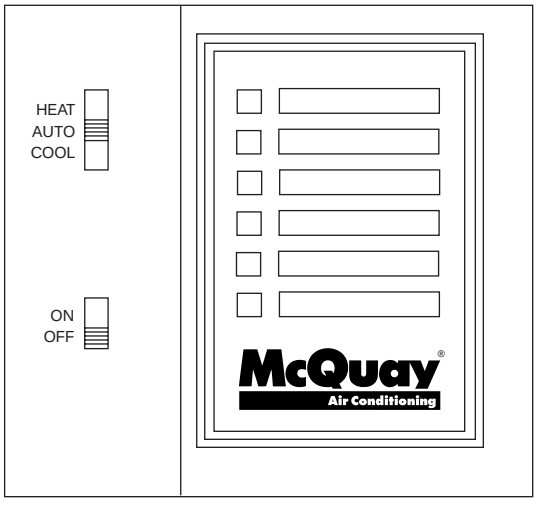
If the Remote Monitor Panel is not used, terminals 101 and 105 must be jumpered to enable cooling, and terminals 101 and 106 must be jumpered to enable heating. The fan is enabled when either cooling or heating is enabled.

Table 13. Low voltage field wiring

WIRE SIZE	MAXIMUM WIRE LENGTH* IN FEET (M)
22	757 (231)
20	1204 (367)
18	1915 (584)
16	3045 (928)

*Maximum wire length is based on a voltage drop of 2 volts.

Figure 30. Optional Remote Monitor Panel



External Time Clock

An external time clock can be used as an alternative to (or in addition to) the MicroTech controller's internal scheduling function. The external timing mechanism is set up to open and close the circuit between field terminals 101 and 102. When the circuit is open, power is not supplied to digital input D1 (terminal DH1-1) on the ADI board. This is the normal condition in which the programmable internal schedule is followed. When the circuit is closed, power is fed to DH1-1. The MicroTech controller responds by placing the unit in the occupied mode, overriding any set internal schedule.

For more information, please see the "Digital Inputs" section of Bulletin No. IM 483, "MicroTech Applied Rooftop Unit Controller."

Smoke Detectors

Option smoke detectors can be located at the supply and return openings. The wiring for these smoke detectors is shown on any of the "Typical Main Control Circuit" schematics in the "Wiring Diagrams" section of this manual.

The sequence of operation for these detectors is as follows: When the smoke is detected by either sensor, the normally closed sensor contacts open. This removes power from digital input D11 (terminal DH2-11) on the ADI board. The MicroTech controller responds by shutting the unit down. The controller is placed in the Alarm Off state, and cannot be restarted until the alarm is manually cleared. Refer to the operation manual supplied with the unit for information on clearing alarms (see Table 1).

The smoke detectors themselves must be manually reset once they have tripped. Power must be cycled to the smoke detector to reset.

Freeze Protection

An optional freezestat is available on units with MicroTech control that have hot water or steam heating coils. The sensing element is located on the downstream side of the heating coil in the heating section of the unit. If the freezestat detects a freezing condition and closes, the MicroTech controller will take different action, depending on whether the fans are on or off. The freezestat is an auto reset type of control; however, the controller alarm it causes is manual rest if the fan is on and auto reset if the fan is off.

Fan on operation

If the freezestat detects a freezing condition while the fan is on, the MicroTech controller will shut down the fans, close the outdoor air dampers, open the heating valve, and set a 10-minute timer. The MicroTech controller's current alarm (menu 29) will be "Freeze Stat Fail."

When the 10-minute timer expires, the controller begins checking the freezestat again. If the freezestat is open, the heating valve will close. If the freezestat closes again, the heating valve will open, and the 10-minute timer will reset.

The unit will remain shut down until the "Freeze Stat Fail" alarm is manually cleared. Refer to the operation manual supplied with the unit for information clearing alarms (see Table 1).

Fan off operation

If the freezestat detects a freezing condition while the fan is off, the MicroTech controller will open the heating valve and set a 10-minute timer. The MicroTech controller's current alarm (menu 29) will be "Freeze Stat Prob."

When the 10-minute timer expires, the controller begins checking the freezestat again. If the freezestat is open, the heating valve will close. If the freezestat closes again, the heating valve will open, and the 10-minute timer will reset.

When the freezestat opens again, the "Freeze Stat Prob" alarm automatically clears. This feature protects the coil and allows the system to start normally after a cold night.

Mixed Air Temperature Alarm

A mixed air temperature (MAT) sensor and an associated "Low Airflow Alarm" are provided on VAV units with MicroTech control and gas or electric heat. The MAT sensor is located in the supply fan section of the unit at the supply air funnel.

Heat will be disabled whenever the airflow is detected to be too low for safe heating operation. This condition is indicated when the supply air temperature exceeds the mixed air temperature by more than 60°F (16°C). In this case, a "Low Airflow Alarm" is generated and heat will not be reenabled until the alarm is manually cleared. Refer to the operation manual supplied with the unit for information on clearing alarms (see Table 1).

Duct High Pressure Limit

The duct high pressure limit control (DHL) is provided on all VAV units, including the CAV-DTC unit that can be field converted to VAV. The DHL protects the ductwork, the terminal boxes, and the unit from overpressurization which could be caused by, for example, tripped fire dampers or control failure.

The DHL control is factory set to open when the discharge plenum pressure rises to 3.5" w.c. (872 Pa). This setting should be correct for most applications; however, it is adjustable. Removing the front cover of the device reveals a scale showing the current setting. Turning the adjustment screw located on the bottom of the device adjusts the setting up or down.

If the DHL switch opens, digital input D7 (terminal DH1-7) on the ADI board will be de-energized. The MicroTech controller then shuts down the unit and enters the Off-Alarm state. The alarm must be manually cleared before the unit can start again. Refer to the operation manual supplied with your unit for more information on clearing alarms (see Table 1).

Variable Inlet Vanes

Variable inlet vanes are installed on the supply and return fans of VAV units. They are also installed on the return fans of constant volume units that have direct building static pressure control capability.

The inlet vane assemblies consist of airfoil type inlet funnels with integral sets of lever-actuated radial vanes. Supply fans have one assembly on each side of the fan. Return fans have one assembly on the inlet side of the fan only. When they open, the inlet vanes direct air in the direction of wheel rotation.

The vanes are able to rotate 90 degrees from full closed to full open. A stop limits the amount of travel open and must not be changed. Driving the vanes past this stop will cause the vane hub cam linkage to disengage. The vanes will turn independently of each other, and the hub assembly will have to be overhauled. The moving parts of the vanes are permanently lubricated. All threaded fasteners must be periodically checked for tightness.

All fans with inlet vanes are provided without motor actuators for field control installation, or may be shipped from the factory with complete linkage and actuator assemblies. Field installed linkages and actuators would be connected at Point B on Figures 31 and 32.

Minimum vane position

Operation with the inlet vanes closed completely may result in fan pulsation and excessive vibration. In units equipped with MicroTech controls, the vanes are automatically opened approximately 5 degrees by the control system prior to fan start-up. Field installed linkages and actuators should be preset to close to no less than 5 degrees open.

Supply fan vane adjustment

Figure 31 shows the supply fan vane linkage assembly. Both sets of vanes on the supply fan must operate in unison. Adjustments to the motor rod end and locknut as well as to the floating link ends (Point A) can be made to assure uniformity between the linkage assemblies.

The vane actuators must have 180-degree rotation. Do not make linkage adjustments to compensate for improper actuator rotation, but correct the actuator rotation adjustment. Refer to “Actuator Rotation Adjustment” section following.

On units with vane controls on both the supply and return fan, it is important that both actuators have exactly 180-degree rotation to assure proper “tracking” of the two actuators.

NOTICE

Inlet vanes must not be adjusted to close tight during fan operation.

A minimum operating position of 5 degrees open is recommended to avoid pulsation.

Units with factory installed MicroTech controls will automatically open vanes 5 degrees prior to start-up.

Return fan vane adjustment

Refer to Figure 32 for 30" and 40" wheels. The vane actuator must have 180-degree rotation. Do not make linkage adjustments to compensate for improper rotation, but correct the actuator rotation adjustment. (Refer to the “Actuator Rotation Adjustment” section following.)

As the actuator crankarm rotates from 0 degrees to 180 degrees, the vanes should move from 0 degree (closed) to 90 degrees (full open). This can be adjusted by changing the linkage rod length by loosening the nut and sliding the rod at Point A or Point B and retightening the nut.

Actuator rotation adjustment

The counterclockwise (as viewed from shaft end of actuator) limit switch is adjustable on the Barber-Colman actuator. The clockwise limit is not adjustable. The counterclockwise limit setting can be changed in the field by inserting a screwdriver through the opening in the top plate directly ahead of the terminal block on the shaft side and engaging the screwdriver blade with the edge of the notched cam nearest the front of the actuator. Turning the cam clockwise (as viewed from the shaft) increases the amount of actuator rotation. Each click of the cam represents about 3 degrees of change in actuator rotation. The actuator should be set for 180-degree rotation.

Convenience Receptacle/Section Lights

A convenience receptacle is provided in the main control box on all units. To utilize this receptacle, a separate field supplied 115V power wiring circuit must be connected to the 115V field terminal block TB1, located in the main control box. Note that the National Electrical Code requires that this circuit be protected by a ground fault circuit interrupter (GFI) device.

Optional lights are available for certain sections in the unit. Each light includes a switch and convenience receptacle, and is powered by the external 115V power supply connected to TB1.

Figure 31. Supply fan vane assembly

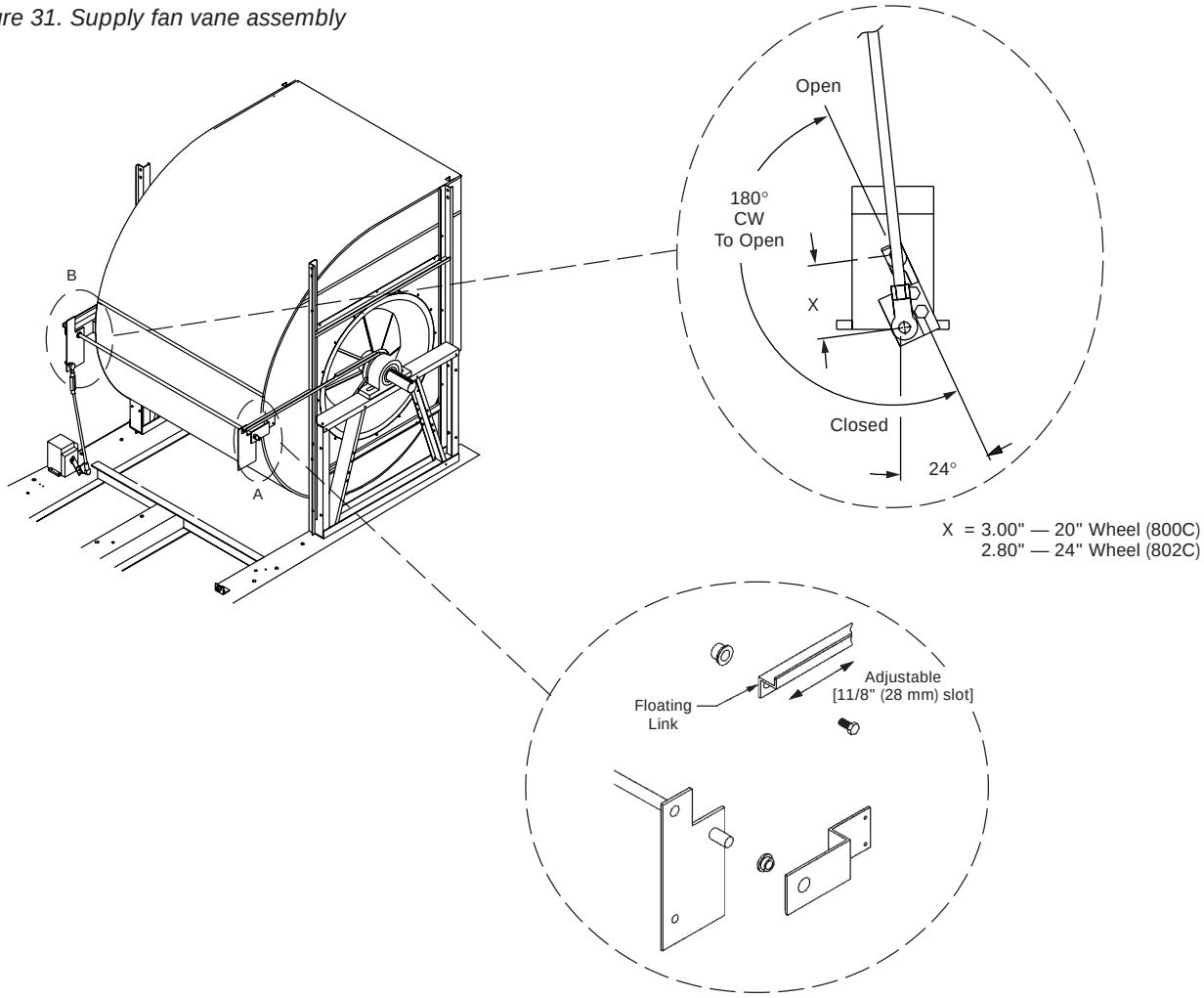
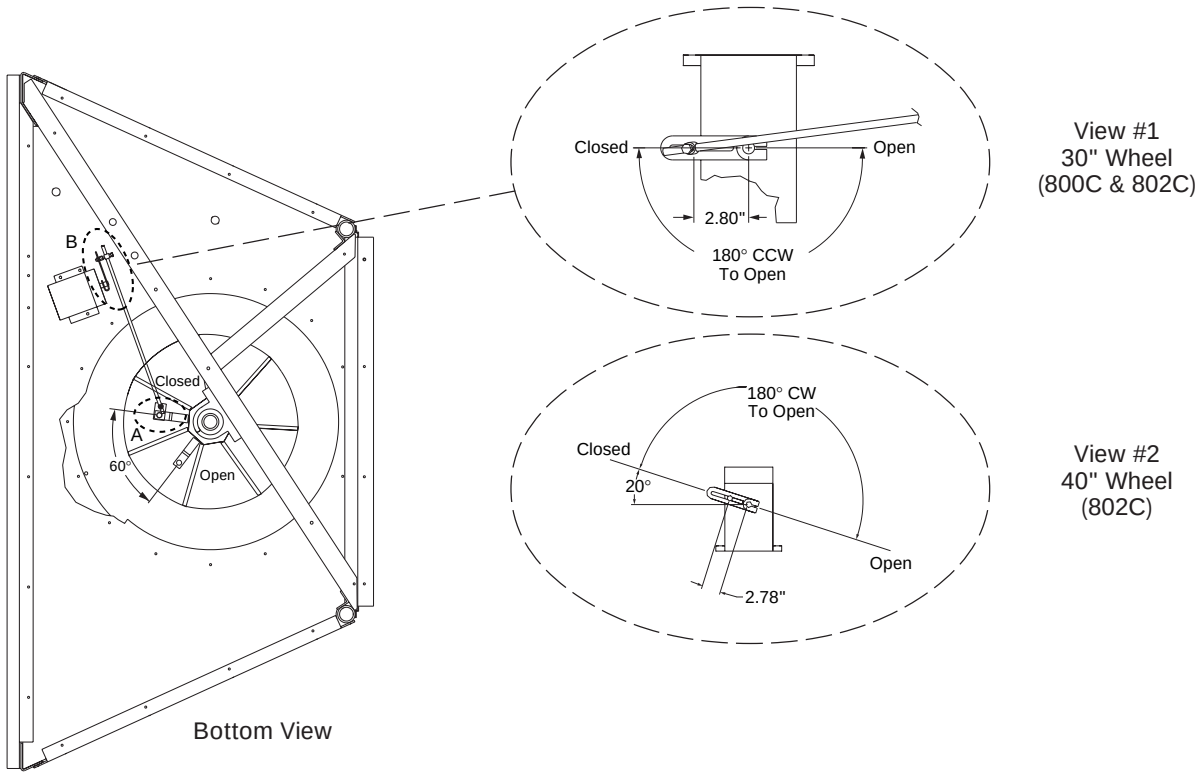


Figure 32. Return fan vane assembly



Check, Test, and Start Procedures

⚠WARNING

Electric shock and moving machinery hazard. Can cause severe equipment damage, personal injury, or death.

All start-up and service work must be performed by qualified technicians who are familiar with the hazards of working on this type of equipment.

Do not attempt to operate or service this equipment without first reading and understanding this manual, the "MicroTech Applied Rooftop Unit Controller" manual (Bulletin No. IM 483), and the applicable operation manual (Bulletin No. OM 108, OM 109, or OM 110).

Assure that the frame of the equipment is bonded to the building electrical ground by use of the grounding terminal or by other acceptable means.

Disconnect electrical power before servicing this equipment.

All units are completely run tested at the factory to assure proper operation in the field. Nevertheless, the following check, test, and start procedures must be performed to properly start the unit. To obtain full warranty coverage, the check, test, and start form supplied with the unit must be completed, signed, and returned to McQuay International.

A representative of the owner or the operator of the equipment should be present during start-up to receive instructions in the operation, care, and maintenance of the unit.

Before Start-up

1. Verify that the unit is completely and properly installed with ductwork connected. Verify that all construction debris is removed, and that the filters are clean.
2. Verify that all electrical work is complete and properly terminated. Verify that all electrical connections in the unit control panel and compressor terminal box are tight, and that the proper voltage is connected.
3. Verify that gas piping is complete and leak tight. Verify that the shutoff cock is installed ahead of the furnace, and that all air has been bled from the gas lines.
4. Manually rotate all fans and verify that they rotate freely. Verify that the belts are tight and the sheaves are aligned.
5. Verify that all setscrews and fasteners on the fan assemblies are still tight. Do this by reading and following the instructions in "Setscrews" which is in the "Maintenance" section of this manual.
6. Verify that the evaporator condensate drain is trapped, and that the drain pan is level.
7. If unit is curb mounted, verify that the curb is properly flashed to prevent water leakage.
8. Before attempting to operate the unit, review the control layout description to become familiar with the control locations.

   Review the equipment and service literature, the sequences of operation, and the wiring diagrams to become familiar with the functions and purposes of the controls and devices.

   Determine which optional controls are included with the unit.
9. Before closing the power disconnect switch, open the following unit control circuit switches:

   a. Main Control Panel
      - Turn system switch S1 to "off."
      - Electric heat units: turn switch HS1 to "off."

   b. Furnace Control Compartment
      - Turn furnace switch S3 to "off."
10. If the VAV or CAV-DTC unit does not have an optional zone temperature sensor (ZNT1) connected to it, change the entry under keypad menu item 28C ("Space Sensor=") from "Yes" to "No."
11. If desired, all MicroTech internal control timers can be reduced to 20 seconds by changing the entry under keypad menu item 28B ("Timers=") from "Normal" to "Fast." This will reduce the delays associated with normal control action for 15 minutes or until the entry is changed back to "Normal."

Power-up

1. Close the unit disconnect switch.
2. Turn the S1 switch to "on." Power should now be supplied to the MicroTech controller, and the LEDs on MCB1 (red, green, and amber) should follow the normal start-up sequence (refer to the "Component Data" section of IM 483).

Fan Start-up

1. If the unit has no controls, check the fan rotation and continue on to step 3. If the unit is equipped with an optional Remote Monitor Panel, turn the on-off switch to "on," and turn the heat-auto-cool switch to "auto."
2. If the unit has no controls, check the fan rotation and continue on to step 3. For units with MicroTech control, place the unit into the "Occ-Fan Only" mode through keypad menu 11 ("Control Mode"). The controller should enter the "Startup Initial" operating state. After the Startup Initial timer has expired (3 to 4 minutes), the fans should start. Observe the fan rotation and, if it is backwards, disconnect power and reverse two legs of the power supply.

   If a fan does not run, do the following:

   a. Check the control circuit fuse F1.
   b. Verify that the overloads have not tripped.
   c. Check the fan motor power fuses.
   d. Verify that the Remote Monitor Panel wiring (if any) is correct.
   e. Trace the circuits.

3. If the fans are equipped with optional spring isolators, check the fan spring mount adjustment. When the fans are running they should be level. Refer to "Spring Isolated Fans" in the "Preparing Unit for Operation" section of this manual for information.

Note: The supply and return fan drives are usually selected for operation in the drive's midspeed range. The return fan drives are usually shipped with fixed pitch sheaves that will provide the selected fan speed; however, the supply fan drives are usually shipped with variable pitch sheaves that are adjusted to provide the minimum fan speed. Both drives should be adjusted for proper airflow during air balancing. For more information, refer to "Air Balancing" near the end of this section.

Economizer Start-up

⚠CAUTION

Improper adjustment may damage the dampers.

Assure proper damper adjustment. When an economizer is ordered without an actuator, the linkage requires a 3.14" linear stroke to fully open it. Do not allow dampers to be driven beyond their normal full closed or full open position.

1. Check whether the outdoor air is suitable for free cooling by displaying keypad menu 9. "Low" indicates low outdoor air enthalpy; "High" indicates high outdoor air enthalpy.
   Referring to "Enthalpy Control" in the "Unit Options" section of this manual, verify that the enthalpy changeover control is working properly. You may want to take temperature and humidity measurements.
2. At the keypad, set the cooling set points low enough so that the controller will call for cooling. On CAV-ZTC units, adjust the "Cooling Spt=" entry on menu item 12C. On VAV or CAV-DTC units, adjust the "Cooling Spt=" entry on menu item 12B and the "Set Point=" entry on menu item 13A.
3. Place the unit into the "Occ-Cool Only" mode through keypad menu 11 ("Control Mode").
4. Observe the outdoor air dampers:
   If the outdoor air enthalpy is low, the Step-and-Wait algorithm should modulate the dampers open.
   If the outdoor air enthalpy is high, the dampers should maintain their minimum position. Set the "Min Airflow=" entry on menu item 21A to some other value. Verify that the dampers move toward the new minimum position set point.
5. If the unit is equipped with the electromechanical enthalpy changeover control (Honeywell H205) and the outdoor air is borderline, attempt to change its input to the MicroTech controller by turning the switch to "A" or "D". Check menu 9. If the changeover occurred, go to step 5 above.

Note: It may not be possible to check the economizer operation in both low and high enthalpy states on the same day. If this is the case, repeat this procedure on another day when the opposite outdoor air enthalpy conditions exist.

Cooling System Start-up

1. Place the unit into the "Occ-Cool Only" mode through keypad menu 11 ("Control Mode").
2. Verify that the low ambient cooling lockout temperature, "Min OAT=" (menu item 13), is set below the outdoor air temperature.
3. At the keypad, set the cooling set points low enough so that the controller will call for cooling. On CAV-ZTC units, adjust the "Cooling Spt=" entry on menu item 12. On VAV or CAV-DTC units, adjust the "Cooling Spt=" entry on menu item 12 and the "Set Point=" entry on menu item 13.

Heating System Start-up

General

1. At the keypad, set the heating set points high enough so that the controller will call for heating. On CAV-ZTC units, adjust the "Heating Spt=" entry on menu item 12D. On VAV or CAV-DTC units, adjust the "Heating Spt=" entry on menu item 12C, and if equipped with modulating heat, the "Set Point=" entry on menu item 14A.
2. Place the unit into the "Occ-Heat Only" mode through keypad menu 11 ("Control Mode").
3. Verify that the high ambient heating lockout temperature, "Max OAT=" (menu item 14B), is set above the outdoor air temperature.

Gas furnace

Refer to the "Start-up and Operating Procedures" section of the forced draft gas fired furnace installation manual, Bulletin No. IM 684 or 685. Perform the start-up procedures given in it.

Electric heat

Turn the electric heater switch HS1 to "on." The electric heaters should energize. If the unit has multistage electric heat, the MicroTech controller should energize the heaters in successive stages. The rate of staging is controlled by menu item 14E, "Stg Timer=" (default is 5 minutes).

Steam heat

The steam valve actuator should open the valve. The steam valve is open when the valve stem is up. If the unit loses power, the spring in the actuator should drive the valve wide open. Check this by opening system switch S1.

Hot water heat

The hot water valve actuator should open the valve to the coil. The three-way hot water valve is open to the coil when the valve stem is down. If the unit loses power, the spring in the actuator should drive the valve wide open to the coil. Check this by opening system switch S1.

Air Balancing

Air balancing should be performed by a qualified air balancing technician. Note that the supply fan motors are usually shipped with variable pitch sheaves which are typically set at the low end of the drive's fan rpm range. See "Mounting and Adjusting Motor Sheaves" below for more information. The return fan motors are usually shipped with fixed pitch sheaves.

⚠WARNING

Moving machinery hazard. Can cause severe personal injury or death.

Use a strobe tachometer to measure the speed of return fans. Safety considerations prohibit the use of a mechanically driven tachometer on this fan arrangement.

The following should be performed as part of the air balancing procedure:

1. Check the operating balance with the economizer dampers positioned for both full outdoor air and minimum outdoor air.
2. Assure that the total airflow will never be less than that required for operation of the electric heaters or gas furnace.
3. For VAV units that have fan tracking control, adjust the supply/return fan balance by using the MicroTech controller's built-in, automatic capability. For complete information on using this feature, see the "Return Fan Airflow Control: Fan Tracking" section in Bulletin No. OM 108, "MicroTech Applied Rooftop Unit Controller: VAV Control."
4. When the final drive adjustments or changes are complete, check the current draw of the supply and return fan motors. The amperage must not exceed the service factor stamped on the motor nameplate.
5. Upon completion of the air balance, replace variable pitch motor sheaves (if any) with comparably sized fixed pitch sheaves. A fixed pitch sheave will reduce vibration and provide longer belt and bearing life.

Mounting and adjusting motor sheaves

VM and VP variable pitch sheaves

Mounting:

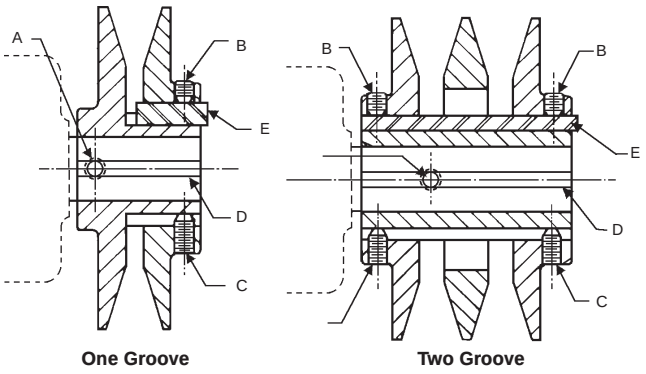
1. All sheaves should be mounted on the motor shaft with setscrew "A" toward the motor (see Figure 33).
2. Be sure both the driving and driven sheaves are in alignment and that the shafts are parallel.
3. Fit internal key "D" between sheave and shaft, and lock setscrew "A" securely in place.

Adjusting:

1. Slack off all belt tension by moving the motor toward the driven shaft until the belts are free from the grooves. For easiest adjustment, remove the belts.
2. Loosen setscrews "B" and "C" in the moving parts of the sheave and pull out external key "E" (see Figure 33). This key projects a small amount to provide a grip for removing.
3. Adjust the sheave pitch diameter for the desired fan speed by opening the moving parts by half or full turns from closed position. **Do not open more than five full turns for "A" belts or six full turns for "B" belts.**

   Adjust both halves of two-groove sheaves by the same number of turns from closed to ensure that both grooves have the same pitch diameter.
4. Replace external key "E" and securely tighten setscrews "B" over the key. Tighten setscrews "C" into the keyway in the fixed half of the sheave.
5. Put on belts and adjust the belt tension. **Do not force belts over grooves.** Loosen the belts by adjusting the motor base closer to the fan shaft.
6. Be sure that all keys are in place and that all setscrews are tight before starting the drive. Check the setscrews and belt tension after 24 hours of service.

Figure 33. VM and VP variable pitch sheaves



Key "E" projects to provide a grip for removal.
Do not operate sheaves with flange projecting beyond the hub end.

LVP variable pitch sheaves

Mounting:

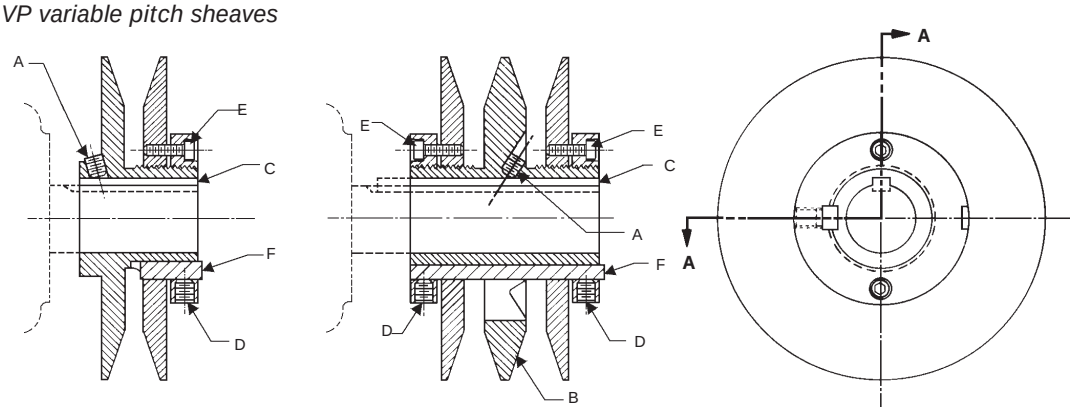
1. For single-groove sheaves, slide the sheave onto the motor shaft so that the side of the sheave with setscrew "A" is next to the motor (see Figure 34).

   For two-groove sheaves, slide the sheave onto the motor shaft so that the side of the sheave with setscrew "A" is away from the motor (see Figure 34).
2. To remove the flange and locking rings:
   a. Loosen setscrews "D".
   b. Loosen **but do not remove** capscrews "E".
   c. Remove key "F". This key projects a small amount to provide a grip for removing.
   d. Rotate the flange counterclockwise until it disengages the threads on the shaft barrel.
3. Be sure that the driving and driven sheaves are in alignment and the shafts are parallel. When aligning two-groove sheaves, allow room between the sheave and motor to get to capscrews "E".
4. Insert key "C" between the sheave and the shaft and tighten setscrew "A" securely.

Adjusting:

1. Slack off all belt tension by moving the motor toward the driven shaft until the belts are free from the grooves. For easiest adjustment, remove the belts.
2. Loosen setscrews "D".
3. Loosen **but do not remove** capscrews "E".
4. Remove key "F". This key projects a small amount to provide a grip for removing.
5. Adjust the pitch diameter by opening or closing the movable flange by half or full turns. Note that two-groove sheaves are supplied with both grooves set at the same pitch diameter. **Both movable flanges must be moved the same number of turns to ensure the same pitch diameter for satisfactory operation. Do not open sheaves more than five turns for "A" belts or six turns for "B" belts.**
6. Replace key "F".
7. Tighten setscrews "D" and capscrews "E".
8. Put on the belts and adjust the belt tension. **Do not force belts over grooves.** Loosen the belts by adjusting the motor base closer to the fan shaft.

Figure 34. LVP variable pitch sheaves



9. Be sure that all keys are in place and that all setscrews and all capscrews are tight before starting the drive. Check and retighten all screws and retension the belts after approximately 24 hours of operation.

MVP variable pitch sheaves

Adjusting:

1. Slack off belt tension by moving the motor toward the driven shaft until the belts are free from the grooves. For easiest adjustment, remove the belts.
2. Loosen both locking screws "A" in outer locking ring, **but do not remove** them from the sheave. There is a gap of approximately 1/32" (1 mm) between the inner and outer locking rings. This gap must be maintained for satisfactory locking of the sheave.

   If locking screws "A" are removed by accident and the gap is lost, screw the outer locking ring down until it touches the inner locking ring. Then back off the outer ring ½ to ¾ turn until the inner and outer ring screw holes are lined up. Reinsert locking screws "A", but do not tighten them until after adjustment is made.
3. Adjust the sheave to the desired pitch diameter by turning the outer locking ring with a spanner wrench. [Any pitch diameter can be obtained within the sheave range. One complete turn of the outer locking ring will result in a 0.233" (6 mm) change in pitch diameter.] **Do not open "A-B" sheaves more than 4¾ turns for "A" belts or 6 turns for "B" belts. Do not open "C" sheaves more than 9½ turns.**
4. Tighten both locking screws "A" in the outer locking ring.
5. Put on the belts and adjust the belt tension. **Do not force belts over grooves.** Loosen the belts by adjusting the motor base closer to the fan shaft.

Caution: Do not loosen any screws other than the two locking screws "A" in the outer locking ring. **These screws must be tightened securely before the drive is operated.**

Figure 35a. MVP variable pitch sheaves (type A-B)

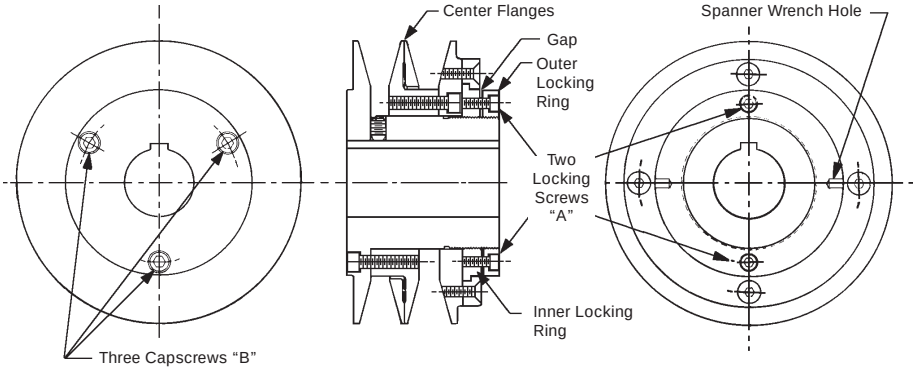
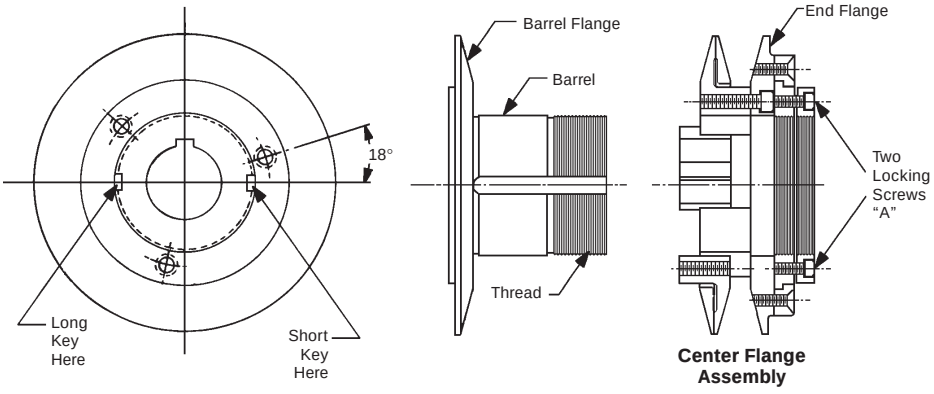


Figure 35b. MVP variable pitch sheaves (type C)



Final Control Settings

When all start-up procedures have been completed, set the controls and program the MicroTech controller for normal operation. Use the following list as a guide; some items may not apply to your unit.

1. Turn system switch S1 to “on.”
2. Turn gas furnace switch S3 to “auto” or turn electric heat switch HS1 to “on.”
3. Set the electromechanical (Honeywell H205) enthalpy control (OAE) as required (A, B, C, or D). Set the solid-state (Honeywell H705/C7400) enthalpy control (OAE/RAE) past “D”.
4. Set the heating and cooling control parameters as required (keypad menus 12 through 14).
5. Set the high ambient heating lockout set point, “Max OAT=” (keypad menu item 14B), as required.
6. Set the alarm limits as required (keypad menu 15).
7. Set the unoccupied heating and cooling set points as required (keypad menu 17).
8. Set the duct static pressure control parameters as required (keypad menu 18).
9. Set the fan tracking or building static pressure control parameters as required (keypad menu 19).
10. Set the economizer control parameters as required (keypad menu 21).
11. Set the dirty filter set points as required (keypad menu 22). If a Remote Monitor Panel is being used, set the set points on dirty filter switches PC5 (filter) and PC6 (optional final filter). The maximum recommended settings are 0.5" w.c. (125 kPa) for throwaway-type filters, 1.0" w.c. (249 kPa) for 30% pleat-type filters, and 1.5" w.c. (374 kPa) for cartridge-type filters.
12. Set the control timers as required (keypad menu 23).
13. Set the date and time (keypad menu 24).
14. Set the operating schedule as required (keypad menus 25 and 26).
15. Place the unit into the Calibrate mode by selecting it from keypad menu 11, “Control Mode.” Calibrate will automatically zero all pressure sensors and calibrate any actuator feedback pots connected to the MicroTech controller. When Calibrate is finished, set the control mode as required.

Maintaining control parameter records

It is recommended that the MicroTech controller’s set points and parameters be recorded and saved for future reference. If the Microprocessor Control Board ever requires replacement, this record will facilitate entering the unit’s proper data. Using the following table, record the data directly on the pages (with a pencil) or on photocopies of the pages. Keep this record in a safe place and remember to update it whenever further changes are made.

Control parameter record

MENU	MENU NAME	MENU ITEM =	FINAL SETTING
11	Control Mode	Manual Off Auto Occupied Occ:Cool Only Occ:Heat Only Occ:Fan Only	_____
12	Ht/Cl Chgovr (VAV & CAV-DTC) Programs: ART1, ART2, ART3, ART4, ART6 and ART8	Cntl Temp = Return Space Network OAT Cooling Spt = ____ °F Heating Spt = ____ °F Clg Diff = ____ °F Htg Diff = ____ °F	_____ _____ _____ _____ _____
12	Heat/Cool (CAV-ZTC) Programs: ART5 and ART7	Cntl Temp = Return Space Network Set Point: T’stat Keypad Cooling Spt = ____ °F Heating Spt = ____ °F Clg Deadband = ____ °F Htg Deadband = ____ °F Clg PA = ____ Min Htg PA = ____ Min Mod Limit = ____ °F Wait time = ____ Min Max Step = ____ %	_____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____

Continued

Control parameter record (cont'd)

MENU	MENU NAME	MENU ITEM =	FINAL SETTING
13	Clg Control (VAV & CAV-DTC) Programs: ART1, ART2, ART3, ART4, ART6 and ART8	Set Point = ____ °F Min OAT = ____ °F Min Spt = ____ °F Max Spt = ____ °F Reset = No Reset Space Return OAT Network External Airflow Min Spt @ = ____ °F Max Spt @ = ____ °F Stg Timer = ____ Min Deadband = ____ °F Mod Limit = ____ Min Wait Time = ____ Sec Max Step = ____ Sec PA Time = ____ Sec	_____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____
13	Clg Control (CAV & ZTC) Programs: ART5 and ART7	Set Point = ____ °F Min OAT = ____ °F OAT Diff = ____ °F Min Spt = ____ °F Max Spt = ____ °F Stg Timer = ____ Min Deadband = ____ °F Mod Limit = ____ °F Wait Time = ____ Sec Max Step = ____ Sec PA Time = ____ Sec	(Status Only) _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____
14	Htg Control (VAV & CAV-DTC) Programs: ART1, ART2, ART3, ART4, ART6 and ART8	Set Point = ____ °F Max OAT = ____ °F Min Spt = ____ °F Max Spt = ____ °F Reset = No Reset Space Return OAT Network External Min Spt @ = ____ °F Max Spt @ = ____ °F Stg Timer = ____ Min Deadband = ____ °F Mod Limit = ____ °F Wait Time = ____ Sec Max Step = ____ Sec PA Time = ____ Sec	_____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____
14	Htg Control (CAV-ZTC) Programs: ART5 and ART7	Set Point = ____ °F Max OAT = ____ °F Min Spt = ____ °F Max Spt = ____ °F Stg Timer = ____ Min Deadband = ____ °F Mod Limit = ____ °F Wait Time = ____ Sec Max Step = ____ Sec PA Time = ____ Sec	(Status Only) _____ _____ _____ _____ _____ _____ _____ _____ _____ _____
15	Alarm Limits	Hi Supply = ____ °F Lo Supply = ____ °F Hi Return = ____ °F	_____ _____ _____
17	Unocc Htg/Clg	Cooling Spt = ____ °F Heating Spt = ____ °F	_____ _____

Continued

Control parameter record (cont'd)

MENU	MENU NAME	MENU ITEM =	FINAL SETTING
18	Duct Pressure (VAV) Programs: ART1, ART2, ART3 and ART4	Duct Spt = ____ "WC Max Spt = ____ "WC Reset = No Reset Network Position Deadband = ____ "WC Mod Lim = ____ "WC Wait Time = ____ Sec Max Step = ____ Sec	_____ _____ _____ _____ _____ _____ _____
19	Ret Fan Cntl (VAV with fan tracking control) Programs: ART1 and ART3	W/ Ex-SFMax = ____ % W/ Ex-RFMax = ____ % W/ Ex-SFMin = ____ % W/ Ex-RFMin = ____ % No Ex-SFMax = ____ % No Ex-RFMax = ____ % No Ex-SFMin = ____ % No Ex-RFMin = ____ %	_____ _____ _____ _____ _____ _____ _____ _____
19	Bldg Pressure Programs: ART2, ART4, ART5 and ART6	Zone Spt = ____ "WC Deadbd = ____ "WC Stg Time = ____ Sec Mod Lim = ____ "WC Wait Time = ____ Sec Max Step = ____ Sec	_____ _____ _____ _____ _____ _____
20	Fan Balance (VAV with fan tracking control) Programs: ART1 and ART3	Balance = Off On Set Max W/ Ex = No Yes Set Max No Ex = No Yes Set Min W/ Ex = No Yes Set Min No Ex = No Yes	_____ _____ _____ _____
21	Outdr Damper (VAV) Programs: ART1, ART2, ART3 and ART4	Min Airflow = ____ % Min Type = None Auto External ____ % @ 5V Ext Enthalpy = Yes No Changeover = ____ °F Chngovr Diff = ____ °F Max Purge = ____ Min Deadband = ____ °F Mod Limit = ____ °F Wait Time = ____ Sec Max Step = ____ Sec PA Time = ____ Sec Max OD Pos Spt = ____ % Max OD Pos @ RF = ____ % Min OD Pos @ RF = ____ %	_____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____

Continued

Control parameter record (cont'd)

MENU	MENU NAME	MENU ITEM =	FINAL SETTING
21	Outdr Damper (CAV) Programs: ART5, ART6, ART7 and ART8	Min Airflow = ____ % Min Type = None External ____ % @ 5V Ext Enthalpy = Yes No Changeover = ____ °F Chngovr Diff = ____ °F Max Purge = ____ Min Deadband = ____ °F Mod Limit = ____ °F Wait Time = ____ Sec Max Step = ____ Sec PA Time = ____ Sec	_____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____
22	Dirty Filter	1st Fltr = ____ "WC Fnl Fltr = ____ "WC	_____ _____
23	Timers Programs: ART1, ART2, ART3, ART4, ART5 and ART6	Recirc = ____ Min Ovrde Inc = ____ Hr Max MWUP = ____ Min	_____ _____ _____
23	Timers Programs: ART7 and ART8	Low SAT = ____ Min Ovrde Inc = ____ Hr	_____ _____
24	Set Date/Time	mm/dd/yy Day hr:mn:sec	_____ _____
25	Schedule	Override = ____ Hr NMP Sched No. = ____ Sun hr:mn-hr.mn Mon hr:mn-hr.mn Tue hr:mn-hr.mn Wed hr:mn-hr.mn Thu hr:mn-hr.mn Fri hr:mn-hr.mn Sat hr:mn-hr.mn Hol hr:mn-hr.mn	_____ _____ _____ _____ _____ _____ _____ _____ _____ _____
26	Holiday Date	#1 Date = MON DY #1 Dur = ____ Day(s) #2 Date = MON DY #2 Dur = ____ Day(s) #3 Date = MON DY #3 Dur = ____ Day(s) #4 Date = MON DY #4 Dur = ____ Day(s) #5 Date = MON DY #5 Dur = ____ Day(s) #6 Date = MON DY #6 Dur = ____ Day(s) #7 Date = MON DY #7 Dur = ____ Day(s) #8 Date = MON DY #8 Dur = ____ Day(s) #9 Date = MON DY #9 Dur = ____ Day(s) #10 Date = MON DY #10 Dur = ____ Day(s) #11 Date = MON DY #11 Dur = ____ Day(s) #12 Date = MON DY #12 Dur = ____ Day(s) #13 Date = MON DY #13 Dur = ____ Day(s) #14 Date = MON DY #14 Dur = ____ Day(s)	_____ _____

Continued

Control parameter record (cont'd)

MENU	MENU NAME	MENU ITEM =	FINAL SETTING
27	Optimal Start	Opt Start = On Off	_____
		Auto Update = Yes No	_____
		Ht Rate = ____ °F/Min	_____
		Heat OAT = ____ °F	_____
		Ht Factor = ____ Min	_____
		Cl Rate = ____ °F/Min	_____
		Cool OAT = ____ °F	_____
		Cl Factor = ____ Min	_____
28	Service	Mode = Normal Shutdown	Normal
		Timers = Normal Fast	Normal
		Space Sensor = No Yes	_____
		OAT = Local Remote	_____
		① Duct Sensor 2 = No Yes	_____
		Alarm Out = Blink Off	_____
		Port A Baud = 1200 2400 9600 19200	_____
		IDENT = ____	_____

① This item applys to programs ART1 and ART3 only. The default is factory set depending on the number of duct static pressure sensors installed.

Maintenance

Installation and maintenance are to be performed only by qualified personnel who are experienced with this type of equipment and familiar with local codes and regulations.

⚠WARNING

Moving machinery and electrical power hazards. May cause severe personal injury or death.

Disconnect and lock off power before servicing equipment.

⚠CAUTION

Sharp edges are inherent to sheet metal parts, screws, clips, and similar items. May cause personal injury.

Exercise caution when servicing equipment.

Preventive Maintenance

Preventive maintenance is the best way to avoid unnecessary expense and inconvenience. Have this system inspected at regular intervals by a qualified service technician. The required frequency of inspections depends upon the total operating time and the indoor and outdoor environmental conditions. Routine maintenance should cover the following items:

1. Tighten all belts, wire connections, and setscrews (see below).
2. Clean the evaporator and condenser coils mechanically or with cold water, if necessary. Usually any fouling is only matted on the entering air face of the coil and can be removed by brushing.
3. Lubricate the motor and fan shaft bearings (see below).
4. Align or replace the belts as needed.
5. Clean or replace the filters as needed.
6. Check for blockage of the condensate drain. Clean the condensate pan as needed.
7. Check the power and control voltages.
8. Check the running amperage of all motors.
9. Check all operating temperatures and pressures.
10. Check and adjust all temperature and pressure controls as needed.
11. Check and adjust all damper linkages as needed.
12. Check the operation of all safety controls.
13. Examine the gas furnace (see Bulletin No. IM 684 or 685).
14. Lubricate the door latch mechanisms.

Unit Storage

If air handling units are to be stored for any period of time, kit is important to periodically rotate the fan wheel. The fan wheel needs to be rotated to prevent any deflection in the fan shaft which could cause unbalanced fan operation. Also, it is important to keep the fan bearings lubricated. If the fan wheel is not periodically rotated, grease will settle in the lower part of the bearing. This can lead to oxidation on the upper portion of the bearing surface which can cause bearing failure.

Gas Furnace

For information on maintenance of the gas furnace, refer to Bulletin No. IM 684 or 685.

Bearing Lubrication

⚠CAUTION

Bearing overheating potential. Can cause damage to the equipment.

Do not overlubricate bearings.

Use only a high grade mineral grease with a 200°F safe operating temperature. Refer to Table 14 for specific recommended lubricants.

Motor bearings

Supply and return fans — Supply and return fan motors should have grease added after every 2,000 hours of operation. Use one of the greases shown in Table 14. Using the following procedure, relubricate the bearings while the motor is warm, but not running.

1. Remove and clean upper and lower grease plugs.
2. Insert a grease fitting into the upper hole and add a small amount of clean grease with a low pressure gun.

3. Run the motor for five minutes before replacing the plugs.

Note: Specific greasing instructions may be found on a tag attached to the motor. If special lubrication instructions are on the motor, they will supersede all other instructions.

Fan shaft bearings

Fan shaft bearings should be relubricated periodically. Relubricate according to the schedule shown in Table 15. If the bearings are exposed to wet conditions, wide temperature variations, or other severe atmospheric conditions, relubricate more frequently. Use one of the greases shown in Table 14.

While the bearing is at normal operating temperatures, rotate the fan by hand and add only enough grease to purge the seals. The seals will bleed slightly when this has occurred. Do not overlubricate.

Table 14. Recommended greases

MANUFACTURER	PRODUCT NAME	TEMP. RANGE (°F)
Texaco Lubricants Co.	Premium RB	–30 to 300
Keystone Ind. Lubricants	84EP-2	–40 to 200
Mobil Oil Corporation	Mobilith AW2	–40 to 325
Chevron U.S.A. Inc.	SRI-2	–20 to 325
Exxon Company, U.S.A.	Ronex MP	–40 to 300
Shell Oil Company	Alvania No. 2	–20 to 240

Table 15. Recommended fan shaft bearing relubrication interval

OPERATING DUTY	BEARING AMBIENT TEMPERATURE		
	TO 130°F	TO 150°F	OVER 150°F
Continuous	6 months	4 months	2 months
12 Hrs./Day	12 months	12 months	6 months

Setscrews

Setscrews lock bearings, sheaves, locking collars, and fan wheels to their shafts. It is very important that all setscrews be checked periodically to assure that they have not loosened. If this is not done, severe equipment damage could occur.

Using Table 16, check the tightness of all setscrews with a torque wrench. Note that if the return fan bearings setscrews must be retightened, a special procedure is required to equally load both bearings (see below).

Table 16. Setscrew minimum torque specifications

SETSCREW DIAMETER (IN.)	MINIMUM TORQUE (FT-LB)
1/4	5.5
5/16	10.5
3/8	19.0
7/16	29.0
1/2	42.0
5/8	92.0

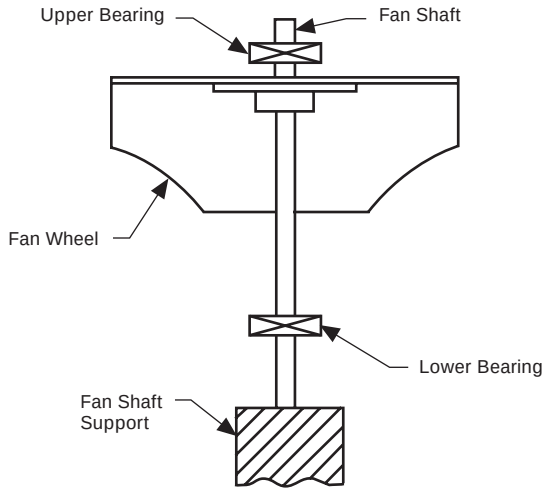
Return fan bearing setscrews

Because the return fan is mounted on a vertical shaft, the following procedure must be used to retighten any return fan bearing setscrews that have loosened. This procedure will assure that both bearings are equally loaded. If one bearing is carrying the entire weight of the fan, it could fail prematurely.

1. Loosen the fan belts.
2. Support the weight of the fan and the fan shaft with timbers or some other suitable means (see Figure 36).

   Important: In order to maintain proper drive alignment and fan-to-tunnel clearance, the fan and shaft must not drop at all when the setscrews are loosened in Step 4 below.
3. Verify that the upper shaft collar is securely fastened to the shaft. Check the setscrew torque.
4. Loosen the upper and lower bearing setscrews. The entire weight of the fan and shaft is now supported by the fan shaft support.
5. Retighten all bearings to the torque specification given in Table 16 above.
6. Remove the fan shaft support and retension the belts.

Figure 36. Return fan assembly



Supply Fan Wheel-to-Funnel Alignment

If the unit is equipped with an airfoil or backward curved supply fan, the fan wheel-to-funnel alignment must be as shown in Figure 37 or 38 to obtain proper air delivery and operating clearance. If necessary, adjustments are made as follows:

1. Verify that the fan shaft has not moved in its bearings.
2. Loosen the fan hub setscrews and move the wheel(s) along the shaft as necessary to obtain the correct dimension shown in Figure 37 or 38.
3. Retighten the setscrews to the torque specification given in Table 16. Tighten the setscrews over the keyway first; tighten those at 90 degrees to the keyway last.
4. Verify that the radial clearance around the fan is uniform. Radial clearance can be adjusted by slightly loosening the funnel hold-down fasteners, shifting the funnel as required, and retightening the fasteners.

Figure 37. 20" airfoil wheel-to-funnel (800C)

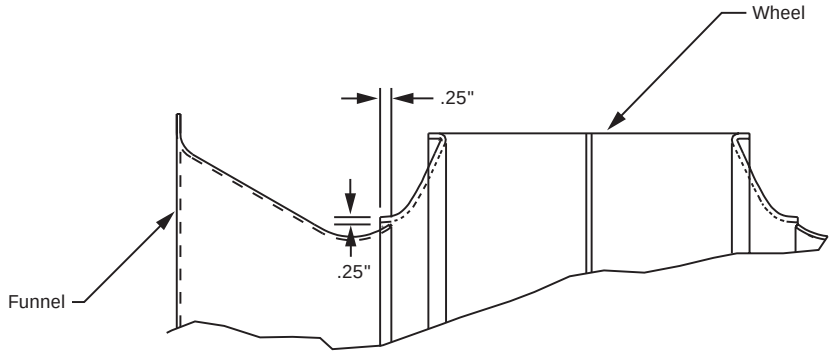
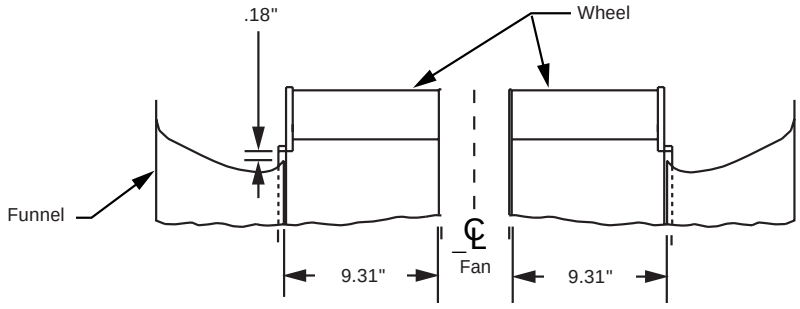


Figure 38. 24" backward curved wheel-to-funnel (802C)



Winterizing Water Coils

Coil freeze-up can be caused by such things as air stratification and failure of outdoor dampers and/or preheat coils. Routine draining of water cooling coils for winter shutdown cannot be depended upon as insurance against freeze-up. Severe coil damage may result. It is recommended that all coils be drained as thoroughly as possible and then treated in the following manner.

Fill each coil independently with an antifreeze solution using a small circulating pump and again thoroughly drain. Check freezing point of antifreeze before proceeding to next coil. Due to a small amount of water always remaining in each coil, there will be a diluting effect. The small amount of antifreeze solution remaining in the coil must always be concentrated enough to prevent freeze-up.

Note: Carefully read instructions for mixing antifreeze solution used. Some products will have a higher freezing point in their natural state than when mixed with water.

Service and Warranty Procedure

In-Warranty Return Material Procedure

Material other than compressors may not be returned except by permission of authorized factory service personnel of McQuay International at Minneapolis, Minnesota.

A "return goods" tag will be sent to be included with the returned material. Enter the information as called for on the tag in order to expedite handling at out factories and issuance of credits. All parts shall be returned to the factory designated on the return goods tag, transportation charges prepaid.

The return of the part does not constitute an order for replacement. A purchase order for the replacement part must be entered through your nearest McQuay representative. The order should include the component's part number and description and the model and serial numbers of the unit involved.

If it is determined that the failure of the returned part is due to faulty material or workmanship, credit will be issued on the customer's purchase order.

Replacement Parts

When writing to McQuay for service or replacement parts, provide the model number, serial number, and G.O. number of the unit as stamped on the serial plate attached to the unit. For questions regarding wiring diagrams, it will be necessary to provide the number on the specific diagram. If replacment parts are required, include the date of unit installation, the date of failure, an explanation of the malfunction, and a description of the replacement parts required.

Product Warranty

McQuay International, hereinafter referred to as the "Company," warrants that it will provide, at the Company's option, either free replacement parts or free repair of component parts in the event any product manufactured by the Company and used in the United States proves defective in material or workmanship within twelve (12) months from initial start-up or eighteen (18) months from the date shipped by the Company, whichever comes first. For additional consideration, the Company warrants that for four (4) years following the initial warranty period it will provide, at the Com-pany's option, free replacement parts for the motor-compressor or free replacement for any integral component of the motor-compressor which proves defective in material or workmanship. For an additional consideration, the Company warrants that for nine (9) years following the initial warranty period it will provide free replacement of the heat exchanger in gas-fired or oil-fired furnaces which proves defective in material and workmanship. (Extended warranties for motor-compressors and heat exchangers are not applicable unless separately purchased.)

To obtain assistance under this parts warranty, extended motor-compressor warranty, or extended heat exchanger warranty, simply contact the selling agency. To obtain information or to gain factory help, contact McQuay International, Warranty Department, P.O. Box 1551, Minneapolis, MN 55440, telephone (612) 553-5330.

This warranty constitutes the buyer's sole remedy. It is given in lieu of all other warranties. There is no implied warranty of merchantability or fitness for a particular purpose. In no event and under no circumstances shall the Company be liable for incidental or consequential damages, whether the theory be breach of this or any other warranty, negligence of strict tort.

This parts warranty and the optional extended warranties extend only to the original user. Of course, abuse, misuse, or alteration of the product in any manner voids the Company's warranty obligation. Neither the parts or extended warranty obligates the Company to pay any labor or service costs for removing or replacing parts, or any shipping charges. Refrigerants, fluids, oils, and expendable items such as filters are not covered by this warranty.

The extended warranties apply only to integral components of the motor-compressor or heat exchanger, not to refrigerant controls, electrical controls, or mechanical controls, or to failures caused by failure of those controls.

Attached to this warranty is a requirement for equipment containing motor-compressors and/or furnaces to report start-up information. The registration form accompanying the product must be completed and returned to the Company within ten (10) days of original equipment start-up. If that is not done, the date of shipment shall be presumed to be the date of start-up and the warranty shall expire twelve (12) months from that date.

No person (including any agent, salesman, dealer or distributor) has authority to expand the Company's obligation beyond the term of this express warranty, or to state that the performance of the product is other than that published by the Company.

McQuay International

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